PICK - A - PECK

Your classroom just got tastier!

Learn About Ag®
California Foundation for Agriculture in the Classroom

Pick-A-Peck Record Book

Make a note of how your class tastes each commodity, whether it is fresh, canned, frozen, etc., or if you are comparing multiple forms and/or varieties. Note which activity/lesson ideas you use to teach students about the commodity, or if you use an idea of your own.

September

Taste	Teach

October

Taste	Teach

November

Taste	Teach

December

Taste	Teach

January

Taste	Teach

February

Taste	Teach

Taste Test Instruction Ideas

Taste tests in the classroom give students access to and new-found knowledge about fruits and vegetables that will help them make improved food choices. Below are ideas on how to conduct this project in your classroom.

Purchase Featured Commodities

Here are four ways to conduct a taste test with your classroom. Try any or all of them!

1. Purchase one commodity for your class to sample.
   Example: Have the class sample almonds.
2. Purchase a few different varieties of a commodity for your class to sample.
   Example: Purchase three different types of apples – try Fuji, Pink Lady®, and Red Delicious.
3. Purchase one commodity and prepare it differently. *Example: Try fresh, cooked, or pickled asparagus.*
4. Purchase one commodity in different forms. *Example: Try fresh, canned, and frozen peaches.*

Taste Test Preparation

1. Before preparing the taste test samples, be sure to wash your hands, utensils, and fresh produce. Prepare a sample for each student.
2. Review rules for tasting with students: Student must wash their hands. If someone doesn't like the sample, they have to explain "why." Students must wait to sample until everyone is ready.

Taste Test Results (with California Education Standards)

1. Have students create their own Taste Test Journal to record their observations and results each month or use the student journal page included in this binder.
   (CCSS ELA: W.K-5.2; W.3-5.7; WHST.6-12.2)
2. Have students record qualitative (observable) and quantitative (measurable) data. Qualitative includes appearance, taste, texture, sound, and smell. Quantitative includes dimensions, weight, amount, and nutritional value.
   (NGSS: 2-PS-1; CCSS ELA: W.K-3.2; W.4-5.2d; WHST.6-12.2d)
3. Have students explain what they liked about the commodity, which variety they liked best, or how they liked the commodity prepared.
   (CCSS ELA: SL.K-12.1)
4. Have students research and become commodity experts! Plan a project night where students share their knowledge and taste test experiences with their families. Include a tasting and student presentations.
   (CCSS ELA: SL.K-2.4, 5; SL.3-12.4, 5; W.K-5.7; WHST.6-12.7)

Taste Test Student Journal

Name: _____ Date: _____

Today I tasted:_____

I like this fruit or vegetable...
(Circle your Choice)

A Lot!

Somewhat

Not Very Much

Use your five senses to describe the color, texture, smell, and taste and sound of this fruit, vegetable or nut:

_____

_____

_____

_____

This is what I learned about California Specialty Crops today:

_____

_____

_____

_____

Word Bank:

Astringent	Colorful	Flavorful	Lingering	Overripe	Ripe	Sour
Bitter	Creamy	Fragrant	Luscious	Plump	Rough	Spicy
Bland	Crisp	Fresh	Messy	Pungent	Savory	Sweet
Chalky	Crunchy	Fuzzy	Moist	Rancid	Slimy	Tangy
Chewy	Delicious	Gritty	Mouthwatering	Refreshing	Smooth	Tart
Clean	Firm	Juicy	Odorless	Rich	Soft	Vibrant

Pick-A-Peck
Food Allergies/Tasting Permission Slip

Dear Parents and Guardians,

Our classroom just got tastier! We were selected to participate in a special program, Pick-A-Peck, sponsored by California Foundation for Agriculture in the Classroom. Throughout the year our class will be tasting a variety of California-grown produce that will be incorporated into our classroom curriculum.

Produce we will taste include (but is not limited to):

Tomatoes
Apples
Kiwifruit
Citrus (Oranges, Mandarins, Lemons)
Nuts (Almonds, Pistachios, Walnuts)
Leafy Greans (Spinach, Lettuce)

To prevent any food-related allergic reactions, please complete this form and have your student return it to me as soon as possible!

☐ My student does not have any known food allergies, and I give my student permission to participate in this activity.

☐ My student DOES have one or more known food alergy. Please exclude my student from the following tastings:

_____

_____

Student Name: _____

Parent Name: _____

Parent Signature: _____

Pick-A-Peck
September - Tomatoes

Five **Fun Facts** About Tomatoes!

- Processed tomatoes (used to make sauces, soups and more!) have thicker skins than fresh market tomatoes. For best flavor, fresh tomatoes should be eaten at room temperature.
- 96% of all processed tomato products eaten in the US come from California.
- Scientifically, tomatoes are considered a fruit. However, the Supreme Court declared them a vegetable because of the way in which people commonly eat them.
- The first tomatoes were the size of cherries!

Three **Fun Teaching Ideas!**

- Brainstorm common meals that have tomatoes in them. Who can name the most?
- Have students complete a tomato-themed page from the *What's Growin' On?* student newspaper.
- Draw a tomato! Tomatoes come in many shapes,colors and sizes. Have students research and draw a tomato variety. Then, students can discuss and compare their drawings with a partner.

Explore all the great tomato resources in this section!

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California Foundation for Agriculture in the Classroom

Commodity Fact Sheet

Processing Tomatoes

Information compiled by the California Tomato Growers Association, Inc.

How Produced – Tomato plants are planted in the field as seeds or as young plants, called seedlings. If sowing seeds directly into the ground, the producer sows seeds in late January or early February. If planting by seedling, plants are grown in greenhouses until they are hardy enough to be planted outside in the spring.

Tomatoes are ready for harvest between early July and mid-October. To avoid the daytime heat, tomato growers often harvest the crop after sunset. Mechanical harvesters move through the fields picking the entire tomato plant and shaking the tomatoes off the vine. Specially designed electronic sensors on the harvesters sort the ripe, red tomatoes from the vine and transfer them into a gondola pulled by a tractor following alongside. The tomatoes are immediately transported from the fields by trucks, which can hold approximately 50,000 pounds of tomatoes. Trucks haul the crop to a nearby state-controlled grading station to be graded, then on to a tomato processing plant where they are peeled, sliced, diced, or sauced into the familiar canned tomato products seen on store shelves.

History – The first tomatoes can be traced to the South American Andes Mountains where they grew wild as cherry-sized berries. Padres following the Spanish conquistadors most likely sent the first seeds to Spain in the early 1500s. The fruit gained little attention in Spain, but soon traveled to Italy—a country that embraced tomatoes with great passion and developed numerous recipes which are still popular today. By the mid-sixteenth century, tomatoes made their return to America via English colonists. They did not become an important part of the American diet, however, until after World War I. Today, tomatoes are grown in every state except Alaska.

Varieties – There are more than 2,750 genetic varieties of fresh market and processing tomatoes at the Tomato Genetics Stock Center at the University of California, Davis. These varieties have been developed to suit the various growing conditions around the state, taking into account soil type, climate, and disease. Processing tomatoes have been selectively bred for more than 50 years to differ from fresh market tomatoes. The varieties designated for processing have a thicker skin and firmer consistency than fresh market tomatoes. These qualities enable the mechanical harvester to pick the fruit when it is ripe without damaging the fruit and ensure tomatoes can survive transportation. The processors prefer the "meatier" character of the processing tomatoes because it provides consumers with more of the tomatoes' essence.

Commodity Value – California is the nation's leading producer of processing tomatoes. In 2015, California's processing tomato growers grew approximately 14 million tons on 296,000 acres throughout the state. The state's crop value reached $1.38 billion in 2015.

Top Producing Counties – As of 2015, Fresno County leads production followed by Yolo, San Joaquin, Kings, and Merced counties. However, nearly the entire state is involved in producing processing tomatoes, with some being grown as far south as Kern County and as far north as Colusa County.

Nutritional Value – Processing tomatoes are are a nutrient dense food. One, four-ounce tomato supplies about one-third of the recommended daily allowance for vitamin C, plus contains beta-carotene, potassium, folic acid, and other B vitamins, iron, and fiber. Tomatoes are a naturally low-calorie food.

Studies show processing tomatoes are the leading source of lycopene in the American diet. Lycopene, the ingredient that makes tomatoes red, is an antioxidant that blocks cellular damage and is highly effective in preventing cancers. Tomatoes do not lose their health benefits as they are processed and cooked. In fact, lycopene in cooked and processed tomatoes (sauce, paste, salsa, canned tomatoes) is more easily absorbed than fresh tomatoes. This fact, along with their popularity, makes tomatoes a leading nutritional source in the American diet.

For additional information:
California Tomato Growers Association, Inc.
(209) 478-1761
Website: www.ctga.org

02/19 Learn About Ag

This is one in a series of fact sheets composed by the California Foundation for Agriculture in the Classroom (CFAITC). For additional educational materials: CFAITC, 2600 River Plaza Drive, Suite 220, Sacramento, CA 95833-3293 • (916) 561-5625 • (800) 700-AITC • Fax: (916) 561-5697
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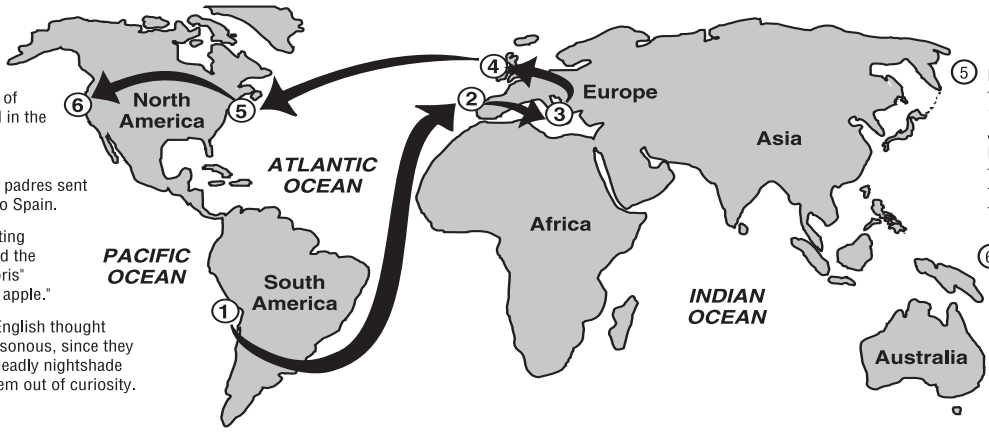
Processing Tomato Activity Sheet

The Tomato's Journey to North America



1. Tomatoes, the size of cherries, grew wild in the Andes Mountains.
2. In the early 1500s, padres sent the tomato seeds to Spain.
3. Italians enjoyed eating tomatoes and called the tomato "poma amoris" which means "love apple."
4. In the 1600s, the English thought tomatoes were poisonous, since they are related to the deadly nightshade plant, and grew them out of curiosity.
5. English colonists brought the tomato to America in the mid-1700s. In 1820, Robert Gibbon Johnson stood on the steps of a New Jersey courthouse, ate a tomato, and lived. Americans finally believed tomatoes were tasty and not deadly.
6. In the 1950s, mechanical harvesters were developed. Scientists began developing tomatoes with tougher skins, fewer seeds and less juice. They also were more rectangular in shape, and greater in yield.

Lesson Ideas

- Label and color the top seven counties in California for processing tomato production.
- Make a collage from labels of various processed tomato products.
- Make a Venn diagram which compares processing tomatoes to fresh market tomatoes.
- Find out why a tomato is scientifically a fruit but is also known as a vegetable.
- Create a class cookbook which includes favorite student recipes using a tomato product.
- Research the Spanish exploration movement of the 1500s. What other "treasures" came from the New World?
- Locate your nearest tomato processor. Where do the tomatoes they process come from?

Fantastic Facts

1. California leads the nation in processing tomato production.
2. Processing tomatoes are harvested by machines.
3. Processing tomatoes have thicker skins than fresh market tomatoes so they can be mechanically harvested and successfully transported.
4. There are 2,750 different varieties of tomatoes.
5. Tomatoes were once thought to be poisonous.
6. Processing tomatoes are rich in vitamin A, vitamin C, potassium, folic acid, beta-carotene, iron, B vitamins, and fiber.
7. The first tomatoes originated in the South American Andes and were berries the size of cherries.

Lesson Plan: pH Perfection

Introduction: When food is preserved, the microorganisms causing food spoilage are destroyed or slowed down. This is done by using extreme temperatures, changing the moisture level, or altering the acidity of the foods. The temperature of canning is extremely important for safety reasons. Foods with a pH higher than 4.6 must be canned at 240ºF or greater. Foods that are more acidic, having pH measurements less than 4.6, may be preserved at 212ºF. This difference in temperature can affect food taste and cost.

Objective: Students will conduct an experiment to determine the ideal temperature for canning tomatoes.

California Standards: NGSS: 5-PS1-3, MS-PS1-4

Materials: Lemon, pear, carrot and tomato juice, litmus paper which shows varying pHs, six paper cups or test tubes, forceps.

Procedure:

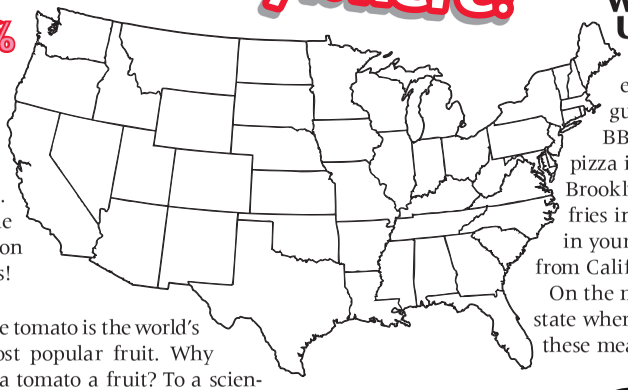
1. Discuss reasons and ways people preserve food. Talk about the importance of acidity and heat in canning.
2. Explain what pH is and how scientists determine the pH of a substance. Talk about the indicator litmus and how it will be used.
3. Pour an equal amount of each substance to be tested into a cup or test tube.
4. Using the forceps, have the students dip one piece of litmus into one substance and record its pH. Repeat this procedure for each juice.
5. Discuss which foods could be preserved at the lower temperature and which need to be canned at the higher temperature. Where do tomatoes fall in this test?
6. What could be done to the foods to change their pHs? When do you think scientists should check the pH of the item to be canned?

02/19 Learn About Ag

This Fact and Activity Sheet was developed by California Foundation for Agriculture in the Classroom in conjunction with California educators and meets the required education standards of the California Department of Education.

Tomatoes Here, Tomatoes There, Tomatoes Everywhere!

96% of all **processed** tomato products eaten in the US come from California. California also leads the world in the production of processing tomatoes!



Where in the US?

Whether you are eating a taco in Sedona, gumbo in New Orleans, BBQ in Kansas City, pizza in Chicago, spaghetti in Brooklyn or a hamburger and fries in Boise, the tomatoes in your meal most likely came from California.

On the map, find and mark the state where you would be eating these meals.

Did You Know?

The tomato is the world's most popular fruit. Why is a tomato a fruit? To a scientist, tomatoes are fruits because they have seeds in them. So cucumbers, pumpkins, and beans are also considered fruits. Vegetables are any part of the plant that is not a fruit: roots (carrots, beets), stems (asparagus, bamboo shoots), leaves (lettuce, spinach), and flowers (broccoli, cauliflower). To a grocer or a chef, a tomato would be considered a vegetable because of how it is used in cooking.

STEM ACTIVITY: Transportation Math

Processed tomatoes have to get from California to states all over the country. Pretend you are a truck driver, starting out in Sacramento, California, and have six cities throughout the country to deliver to. Using information from the table, calculate the following:

- How many miles is it round trip to deliver your load? Please fill in the table.
- How long will it take you to get to each city along the route if you are traveling at 60 mph? Round to the nearest hour, fill in the table.
- If your truck gets 5 mpg in diesel, how many gallons of diesel will you use? Round to the nearest tenths place, fill in the table.
- Using an average diesel cost of $3.25 per gallon, how much will you spend on your trip in diesel? Fill in the table.
- Total all of your columns: mileage, hours driven, gallons used, and $ spent on diesel
- CHALLENGE: How many days will it take you to go round trip (return to Sacramento)? You can only drive 11 hours per day and only 60 hours per week.

Destination: city to city	Mileage (in miles)	Hours Driven (nearest hour)	Gallons used (round to tenths)	$ spent on diesel (round to hundredths)
Sacramento-Boise	555			
Boise-Sedona	878			
Sedona-Kansas City	1,138			
Kansas City-New Orleans	845			
New Orleans-Chicago	926			
Chicago-Brooklyn	799			
Brooklyn-Sacramento	2,833			
Totals				

(Answers: 1. 7,974 miles, 2. 9 hrs., 15 hrs., 19 hrs., 14 hrs., 15 hrs., 13 hrs., 47 hrs. 3. 1,594.8 gallons, 4. $5,183.10, 5. Mileage: 7974 miles. Hours: 132 hours. Gallons: 1,594.8 gallons, $ on diesel: $5183.10, 6. It takes 132 hours of driving time. Since you can only drive 60 hours per week, it will take you two weeks plus 2 days or 16 total days.

Career Spotlight

Career: Truck Driver

Chris Eck, Core-Mark, West Sacramento, CA

What is the training for truck driving? Training requires classes through the Department of Transportation or a private company to get your permit. Then you have to pass a DMV test to get your Class A license.

What do you haul? I haul many products. Some examples are tomatoes, milk, candy, and lemons.

What are some facts about truck driving? My truck gets between 4-6 miles per gallon depending on the weight of the **freight**. I can drive 11 hours per day but need 10 hours of downtime between shifts. I can drive 60 hours per week. If you see a truck pulled off the freeway, they may be taking a required break.

What is a tip you have for us about truck drivers? Always give truck drivers time, we can't always see you and don't stop fast!

Did You Know?

For best flavor, tomatoes should be eaten at room temperature.

Newspaper Activity

Tomatoes Everywhere

Create a newspaper advertisement promoting tomatoes that includes reasons why people should buy them. Use information from this page.

Extension: Why do you think tomatoes are so popular? Write a persuasive essay about tomatoes explaining why you think they are so popular. Use evidence from this page and do some of your own research.

CA Standards: ELA CCSS: RI.3-5.1, 7, W.3-5.2, RI.6-8.1, RI.6.7, W.6-8.2, W.6-8.9, RH.6-8.7; Math CCSS; 5.NBT.5, 6.NS.3, 7.NS.2

Sources: http://learnaboutag.org/resources/fact/tomatoes.pdf; www.transportation.gov

The Tomato Trek

The Journey to California

The first tomatoes can be traced to the South American Andes Mountains where they grew wild as cherry-sized berries. Padres following the Spanish conquistadors likely sent the first seeds to Spain in the early 1500s. The fruit gained little attention in Spain, but soon traveled to Italy—a country that embraced tomatoes with great passion. By the mid-sixteenth century, English colonists brought tomatoes back to the Americas, settling in the northeastern part of the country. Tomatoes likely reached California by the late 1700s, as Spanish missions were established throughout the state.

Activity

Draw arrows to track the tomato's journey from its origin to California.

Standards: ELA – **Grades 6-8:** Reading in History-Social Science 3, 7; History-Social Science – **Grades K-5:** Chronological and Spatial Thinking 1, 4; **Grades 6-8:** 1, 3

Tomatoes on Trial

In 1893, the U.S. Supreme Court heard a case to determine whether the tomato was a fruit or a vegetable. In the case of "Nix v. Hedden," the tomato was declared a vegetable, along with cucumbers, squash, beans, and peas.

Use the historical report from the trial *(caselaw.lp.findlaw.com/cgi-bin/getcase.pl?court=US&vol=149&invol=304)* to record at least three arguments as to why tomatoes should be classified as a fruit or a vegetable. Use your findings to support your stance in an oral debate.

The Great Debate

Fruit	Vegetable
1.	1.
2.	2.
3.	3.

Standards: Science – **Grade 3**: 5b; **Grade 7:** 5f; ELA – **Grade 3:** Reading Informational Text (RIT) 2, Writing 1b, Speaking and Listening (SL) 1; **Grade 4:** RIT 2, Writing 1b, SL 1; **Grade 5:** RIT 2, Writing 1b, SL 1; **Grade 6:** 1b, SL 1; **Grade 7:** 1b, SL 1; **Grade 8:** 1b, SL 1; History-Social Science – **Grades 6-8:** Research, Evidence, and Point of View 3, 4; Historical Interpretation 2, 3

Sources: California Tomato Growers Association (www.ctga.org)

Tomato Vine Timeline

Use the information on this page to create a timeline featuring significant events in tomato history. Include the date and description of each event, in chronological order.

Standards: ELA – **Grades 3-5:** Reading Informational Text 9; **Grades 6-8:** Reading Informational Text 9; History-Social Science – **Grades 6-8:** Chronological and Spatial Thinking 2

Did You Know?

The mechanical tomato harvester was developed in California in the 1950s.

Pick-A-Peck
October - Apples

Five **Fun Facts** About Apples!

- On average, Americans eat more apples than any other fruit.
- 25% of an apple's volume is air. That's why they float in water.
- The four leading varieties of California apples are Gala, Granny Smith, Fuji and Pink Lady®.
- It takes about 36 apples to create one gallon of apple cider.
- Apple trees are not typically grown from seed because it takes about 15 years for an apple tree to grow from a seed until it produces its first apple. Instead, most apple trees are grown by grafting. (Learn about grafting in the January section; walnut trees are also grafted.)

Three **Fun Teaching Ideas!**

- Have students read the story, *The Incredible Apples* (published in the enclosed book and printed in this section). This was the sixth-grade, winning story in the 2015 *Imagine this*... Story Writing Contest! Then, have students write their own creative plots related to apples or another California-grown commodity. Submit the top five entries from your class to the contest by November 1, and your students will have a chance to become published authors! See details in the contest flyer, and watch videos at **LearnAboutAg.org/imaginethis**.
- Compare the earth to an apple! Try the *Apples to Earth* Ag-Bite activity.
- Have students write a poem about apples, using adjectives to describe the 5 senses. See the *A is for Apples* lesson plan.

Explore all the great apple resources in this section!

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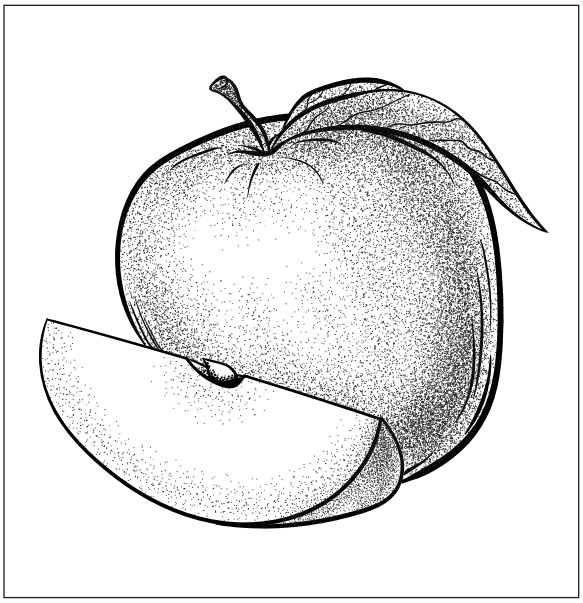
California Foundation for Agriculture in the Classroom

Commodity Fact Sheet

Apples

Information compiled by the California Foundation for Agriculture in the Classroom

How Produced – Grafting, a horticultural technique that joins two plant structures together, is the first step in apple production to ensure that rootstock and varieties will bare fruit. Once planted, it takes four to five years for the tree to produce the first fruit and will produce fruit for up to 100 years. Most apple varieties are self-sterile, meaning unable to pollinate themselves and rely upon cross-pollination. The most commonly used pollinator is crab apples (also known as wild apples) in which pollination takes place in the spring, when trees are in blossom. Once pollinated, blossoms fall to the ground and small apples begin to grow in the blossom's place.



During spring and summer, apple trees require frequent watering. Apple trees can tolerate a great deal of heat if they have sufficient water. The apple crop is harvested by hand in the fall. To insure crop production for the following year, trees must be pruned yearly in the winter to promote new vegetative growth.

History – The first documented history of apples dates to 300 B.C. in the Persian Empire, where the cultivation and enjoyment of apples was an essential part of civilized life. In the 1400s apples were rediscovered and in the 1500s regained popularity again as a common commodity. During this time, European settlers of the Americas brought with them their English custom varieties, and the first apple orchard was planted in America. William Blackstone was the first pilgrim to plant apples trees grown in the United States in the Massachusetts Bay Colony in 1629.

In the early 1800s stories began circulating about John Chapman, better known as Johnny Appleseed, who traveled across the Ohio Valley carrying bags of apple seeds. Venturing westward, he planted seeds and grew apple trees wherever he roamed to ensure that settlers living in the western frontier would have nutritious apples to eat. Apples have a place in more recent history, too. In 1962, the first American to orbit the Earth carried pureed applesauce to consume during the flight.

Varieties – The apple, scientifically known as Malus domestica, is a member of the rose family. California has almost 14,000 acres dedicated exclusively to apple production. California grows four main varieties: Gala, Fuji, Granny Smith, and Cripps Pink. Within the United States, roughly 2,500 varieties of apples are grown. The top 10 apple varieties grown within the United States are Red Delicious, Golden Delicious, Fuji, Granny Smith, Rome Beauty, McIntosh, Idared, Jonathan, Gala, and York Imperial.

Commodity Value – The United States' 7,500 apple producers grow approximately 240 million bushels of apples each year on 322 thousand total acres of land. The wholesale value of the United States apple crop is approximately $4 billion annually. Worldwide, the United States ranks second to China in apple production. California ranks fourth in U.S. apple production, generating 12 percent of the national apple crop which is approximately 800 million pounds annually. Seventy-five percent of the apples produced in California will be shipped domestically and 25 percent are exported. Canada, Malaysia, Mexico, Taiwan, and Panama are five of the 27 global destinations California exports to.

Top Producing Counties – There are five major regions in which apples are grown in California. Historically, apple production was limited to the coastal mountains, the Sierra foothills, and in the Southern California mountains. Recently apple production has expanded into the Central Valley with new plantings of Granny Smith, Fuji, Gala, and other varieties. Important coastal apple producing counties are Sonoma, Santa Cruz, and San Luis Obispo. The major apple production areas are in the San Joaquin Valley with Kern, Fresno, San Joaquin, and Madera counties being the leading producers.

Nutritional Value – One medium-sized apple provides 20 percent (five grams) of the daily requirement for dietary fiber, eight percent of the daily requirement for vitamin C, and is a healthful source of potassium. One apple has approximately 80 calories and contains no fat, cholesterol, or sodium.

For additional information:
California Apple Commission
Phone: (559) 225-3000
Website: calapple.org

CALIFORNIA APPLE COMMISSION

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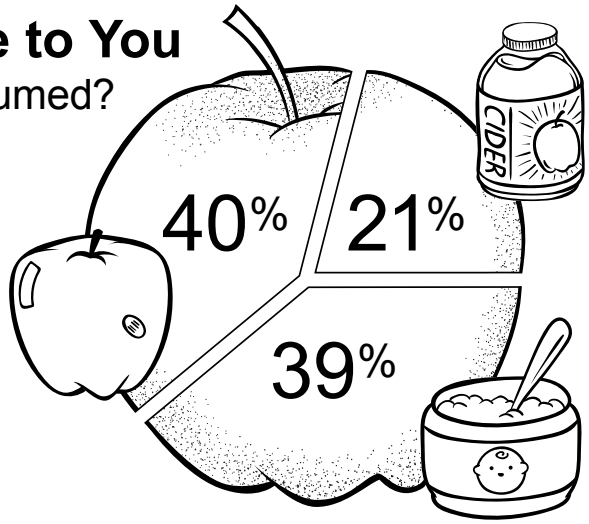
Email: info@learnaboutag.org • Website: LearnAboutAg.org

Apples Activity Sheet

From Apple Tree to You

How are apples consumed?



Fresh market

Apple juice and cider

Processed into dried fruit, baby food, and other products

Lesson Ideas

- Dissect and examine the anatomical parts of an apple. Observe and identify the function of each structure.
- Research and explain the aphorism “an apple a day keeps the doctor away” using nutritional information.
- Observe and practice various grafting techniques used to grow apples.
- Compare hand and machine harvesting methods. Invent a harvesting machine for apples.
- Perform experiments that show the different methods of preserving apples.
- Research and determine what the top ten apple varieties are and why they are most popular amongst consumers.
- Calculate the percentage of water weight in apples by dehydrating the fruit.
- Sprout an apple plant from a seed.

Fantastic Facts

1. The crabapple is the only apple native to North America.
2. Apples are propagated by two methods: grafting or budding.
3. The apple variety “Red Delicious” is the most commonly grown apple variety worldwide.
4. Apples are a member of the rose family.
5. Twenty-five percent of an apple’s volume is air, which makes it naturally buoyant.
6. It takes the energy from 50 leaves to produce one apple.
7. World’s top apple producers are China, United States, Turkey, Poland, and Italy.
8. Archeologists have found evidence that humans have been enjoying apples since 6500 B.C.
9. Apples account for 50 percent of the world’s deciduous fruit tree production.
10. Two-thirds of an apple’s fiber and antioxidants are found in the peel.

Lesson Plan: Sugar or Starch

Introduction: Apples naturally contain starch also known as carbohydrates. When an apple begins its ripening process, starches are converted into sugar. This conversion process starts at the core of the apple and moves outward toward the skin. To check the ripeness of the apple an iodine test can be used to identify the amount of starch present.

Objective: Students will investigate the ripening process of apples by conducting an iodine experiment.

Standards: NGSS: 4-LS1-2, 3-5-ETS1-3; CC ELA: L.W.4-5.7

Materials: Variety of apples, iodine tincture, nitrile gloves, safety goggles, paintbrush, knife, paper plates or towels

Procedure:

1. Safety note: Iodine tincture is a hazardous material and should be handled with care. Wash hands after use and avoid contact with the eyes and skin.
2. Place individual, whole apples on labeled plates (1, 2, 3, 4, etc.) and instruct students to observe each apple’s size, color, texture, and firmness. Have students hypothesize, based on their previous knowledge, which apples are at peak ripeness.
3. Cut apples in half, displaying both sides of the apples on each labeled plate. Have students observe each apple’s internal characteristics.
4. With the paintbrush, evenly apply iodine across the cut surface of each top apple half. Let the apple sit for two minutes. Leave the other apple half untouched as a control to compare changes in each apple.
5. Observe the surfaces of the apples. Large amount of purple indicates high starch/low sugar. Little to no purple indicates low starch/high sugar.
6. Place apples on a continuum from least to most ripe. Make concluding observations.
7. Write a conclusion paragraph on your experimental findings.

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This Fact and Activity Sheet was developed by California Foundation for Agriculture in the Classroom in conjunction with California educators and meets the required education standards of the California Department of Education.

Comparing Apples and... Earth?

Grades 3-5

Explore how much of the Earth's surface is needed for growing food for a world of people.

Activity

1. Hold up an apple to the class and tell the students that it represents Earth.

2. Slice the apple into fourths. Set aside three of the fourths, as they represent water on the Earth's surface.

3. Cut the remaining slice in half. Set aside one of the halves as uninhabited deserts, swamps and Arctic areas.

4. Divide the remaining piece into fourths. Set aside three of the pieces for land that is too rocky, wet, hot, or poor for crop production.

5. The remaining piece is 1/32 of the original apple. Carefully, peel this section. Hold up the peel and explain that it represents the thin layer of soil that is available for producing all of the world's food crops.

Classroom Discussion

- What is the key message underlying the activity?
- What actions can students take to care for their patch of this precious Earth—as individuals, as a class and school, with their families, in their community?
- How are farmers stewards of the land?
- What is sustainability? Introduce the concepts without using the word itself, which can be difficult to define. Produce concept maps based on discussion.
- How do natural resource management, farming techniques, feeding the world, land care, and environmental management play a role in food production in California or your specific region?

Classroom Activities

English Language Arts/History

- Have students journal about this activity, what they learned from the demonstration, and different ways they can take care of the Earth.
- Research different farming practices used in the past and create a chart with the pros and cons of each one. Report your findings to the class.

Visual and Performing Arts

- Create art stamps using different tools (paperclip, toothpick, popsicle stick) to make designs in the apple pieces. Mix paints to produce different colors and dip the stamps in paint to create art.
- Use the activity as a prompt or an example for students to produce a game, puzzle, poster or other means of delivering a similar message.

Materials

Enough for each student:

- Apple (or a paper cutout of an apple)
- Knife
- Chopping board or plates
- Paper towels or wet wipes

Tip

A demonstrator could cut one apple and students eat an approximate amount.

Watch Online!
See a video of this Ag-Bite at LearnAboutAg.org/agbites

California Standards:

Grade 3
Math CC: 3.NF.1
NGSS: 3-LS4-4

Grade 4
Math CC: 4.NF.3a, 3b
NGSS: 4-ESS3-1

Grade 5
Math CC: 5.NF.2
NGSS: 5-ESS3-1

Adapted from materials by the Natural Resources Conservation Service

This is one in a series of Ag-Bites developed by CFAITC. Ag-Bites meet the standards of the California Department of Education.
2600 River Plaza Drive, Suite 220, Sacramento, CA 95833-3292 • (800) 700-AITC • info@LearnAboutAg.org • LearnAboutAg.org

Imagine this...

The Incredible Apples

By Jaden Fontes
2015 *Imagine this...* Story Writing Contest Winner
6th Grade, St. Stanislaus Catholic School
Judee Sani, Teacher
Stanislaus County

Hello, my name is Mac McIntosh, and I am the Super Duper Orchard Hero. I have three best friends, Ferris Fuji, Gary Gala, and Hank Honeycrisp. We are the Fantastic Four. My superpower is super speed. My buddy, Ferris, is the flier, Hank has super strength, and Gary can disappear into thin air and withstand harsh weather.

We grew up together in our orchard. Granny Smith took care of us. We were orphans in the beginning; four poor apples in a bushel of Red Delicious. That farmer just left us all alone because we were not the same as the others, but Granny did not care. She loved us anyway. One day, we were playing in our orchard, when we heard a truck pull up and a big cloud of dust engulfed us. We went running to see what was up. Out of the truck, rolled a fine Pink Lady®. YOWZA!! I got bit by the love bug.

After that, I was always trying to impress Penny Pink Lady®, but one day, I looked all over for her and she was missing. I knew it had to be the orchard villain, Benny Bruiser. He knew that would get to me. We had to find her, after all, she was my Pink Lady®. Penny hated Bruiser, and I knew she had to be scared.

My buddies and I got together to make a plan. It was a foggy evening; we could not see much that night. I told Ferris to fly around the perimeter of the orchard. He took Gary with him to search for any evidence. Sure enough, they saw Penny Pink Lady® tied up. She was being guarded by that crazy Apple Jack.

Gary made himself invisible to look for Bruiser. Soon, Gary signaled to us; they were four rows away. I grabbed Bruiser by his stem, spun him around faster than the speed of light. Ferris flew in and punched him right in his core and Hank turned Bruiser into apple sauce.

From that day forward, Penny was pie in my hands. We knew we were meant to be; we got married and had four super fritters of our own. We had three boys and one girl: Cortland, Jonathan, Spy, Ida, and our dog, Spartan.

We were hoping one of them would have a super power, but no… it was a complete turnover. Later in life, we did find that Spartan has the super power of elasticity—he could stretch like caramel on an apple and had the ability to poop apple dumplings. That has nothing to do with this story really, just a little crisp humor. With his elasticity power, he protects our family. Spartan is the protector of our orchard. He keeps out all of the crazy cobblers with his stretching abilities. Thanks to him, we will always be a safe bunch.

Learn more about the "Imagine this.. Story Writing Contest" by visiting LearnAboutAg.org/imaginethis !

A Is For Apples

Grade Level(s)

K - 2

Estimated Time

1.5 hours

Purpose

Students will use the five senses to investigate apples, identify and model the parts of an apple, make applesauce, and learn how apples are grown.

Materials

Activity 1: Five Senses Apple Investigation

- Red, yellow, and green apples
- Cutting board
- Knife
- *5 Senses Chart*, 1 per student
- Red, yellow, and green interlocking cubes
- *Apple Book Template*
- Red, yellow, or green card stock, 2 pieces per student
- Lined paper, 5 pieces per student
- Hole punch
- Ribbon

Activity 2: Identifying Parts of an Apple

- Apple
- Cutting board
- Apple slicer
- Knife
- *1* set of *Apple Parts Cards*

Activity 3: Apple Model

- Example of *Apple Model* (make your own following the instructions in *Activity 3*)
- 4 .5" x 9" yellow, red, or green construction paper
- 5" x 9" white construction paper

- 1" x 3" brown construction paper
- Brown, green, and black construction paper
- Glue sticks
- *Apple Parts Cards*, 1 set per student

Activity 4: Making Applesauce

- Slow Cooker
- *Crock Pot Applesauce* recipe
- Apple peeler corer slicer
- 8 tart apples
- 1 cup sugar
- 1 teaspoon cinnamon
- 2 cups water
- 2 tablespoons lemon juice
- Liquid measuring cup
- Teaspoon
- Wooden spoon
- Plastic cups, 1 per student
- Plastic spoons, 1 per student

Essential Files (maps, charts, pictures, or documents)

- Crock Pot Applesauce Recipe
  [https://naitc-api.usu.edu/media/uploads/2015/11/09/Crock_Pot_Applesauce.pdf]
- Apple Parts Cards
  [https://naitc-api.usu.edu/media/uploads/2015/11/09/Apple_Parts_Cards.pdf]
- Apple Book Template
  [https://naitc-api.usu.edu/media/uploads/2015/11/09/Apple_Book_Template.pdf]
- 5 Senses Chart
  [https://naitc-api.usu.edu/media/uploads/2015/11/09/5_Senses_Chart.pdf]

Vocabulary

skin: covers and protects the apple's flesh and seeds

flesh: the sweet part of the apple that you can eat

stem: attaches the apple to the apple tree, bringing water and nutrients to the apple

seeds: can be used to grow new apple trees, but it takes a long time

calyx: what is left of the apple blossom

orchard: a piece of land planted with fruit trees

Did you know? (Ag Facts)

- On average, Americans eat more apples than any other fruit.[2]
- It takes about 36 apples to create one gallon of apple cider.[2]
- 25% of an apple's volume is air; that's why they float in water.[2]

Background - Agricultural Connections

The average American consumes approximately 65 apples a year. There are over 7,500 varieties of apples in the world and about 2,500 varieties are grown in the United States. Apples are the fruit of apple trees. They have green, red, pink, or yellow skin and are used to make apple juice, cider, vinegar, applesauce, and many kinds of salads and desserts.

Apple trees do grow in all 50 states, but for efficient fruit production they require a cold period called vernalization. Vernalization takes place during the cold winter months while an apple tree is dormant. Without this cold period, apple trees will not develop sufficient flower buds to produce a good crop of apples. The top three apple producing states in the US are Washington, New York, and Michigan.[1] All three of these states have a significant winter season.

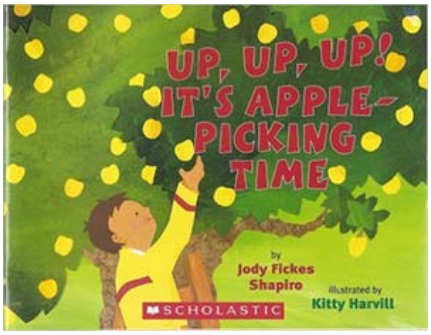
Apple trees are not typically grown from seed because it takes about 15 years for an apple tree grown from seed to produce an apple. Instead, most apple trees are grown by budding or grafting onto rootstocks—sections of tree roots still attached to a part of the tree trunk. Budding involves taking one bud from an existing tree branch and attaching it under the bark of a rootstock with special grafting tape or glue. Grafting is similar, but rather than a single bud, a section of a stem with multiple leaf buds is attached to the rootstock with grafting glue and tape. Grafted or budded trees usually grow in a nursery for about one year before being planted in an **orchard**.

An apple can be divided into several parts. The **skin** covers and protects the apple's **flesh** and **seeds**. The **flesh** is the sweet part of the apple. The **stem** is what attaches the apple to the apple tree, bringing water and nutrients to the apple. The **seeds** can be used to grow new apple trees. The **calyx** is what is left of the apple blossom.

Honeybees are commonly used to pollinate apple trees. Almost all varieties of apples require cross-pollination, meaning that pollen from a different variety is needed to produce fruit. Apple trees require full sunlight and well-drained soil. Most apples are ready to harvest in the late summer or early fall.

We've all heard the saying, "An apple a day keeps the doctor away." While eating apples does not guarantee good health, apples do have healthy benefits. Apples are naturally fat-, sodium-, and cholesterol-free and are an excellent source of dietary fiber and antioxidants. A medium apple contains about 80 calories and is loaded with vitamin C and beta-carotene. Be sure to eat the skin. Most of the fruit's antioxidants, vitamin C, and fiber are located in, or just under, the skin.

Interest Approach – Engagement



1. Read the book *Up, Up, Up! It's Apple-Picking Time* by Jody Fickes Shapiro. As you read, discuss the following questions with the students:
   - *Where do apples grow?*
   - *What colors can apples be?*
   - *What are apples used for?*
2. After reading the book and answering the questions, transition to *Activity 1* by telling students they will be learning more about about apples and their senses.

Procedures

Activity 1: Five Senses Apple Investigation

1. Before beginning this activity, students should wash their hands.
2. Ask students to identify their five senses—see, smell, feel, hear, taste. Explain that they will be using their five senses to observe apples. Give each student a *5 Senses Chart.*
3. Show students the three different types of apples. Ask them to describe what they see. Point out the skin, stem, and calyx. The calyx is the remaining part of the apple blossom located on the end of the apple opposite of the stem. Cut an apple in half crosswise. Ask the students to describe what they see. Point out the shape of the star, the seeds in the star pockets, and the flesh. Write their descriptive words on the on the board (as pictured) under the "See" column. Explain that descriptive words are called adjectives. The

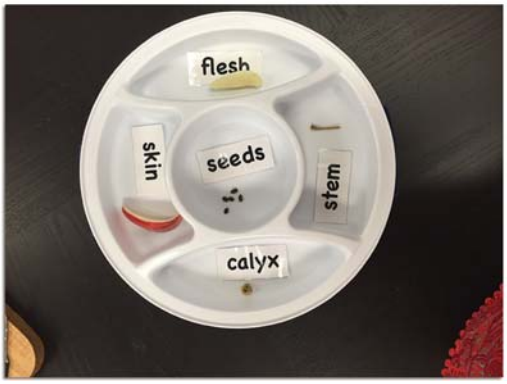
students should choose at least two adjectives to write on their own *5 Senses Chart*. At the end of the activity, they will use the adjectives on their chart to write a poem about apples.

4. Cut each apple into slices. Give a green, red, and yellow slice to each student. Ask them to smell the apples and describe what they smell. Write their adjectives on the poster under the “Smell” column and have them write at least two adjectives on their chart.
5. Ask the students to feel the apple slices and describe what they feel. Write their adjectives on the poster under the “Feel” column and have them write at least two adjectives on their chart.
6. Ask the students to take a bite out of one apple slice and describe what they hear. Write their adjectives on the poster under the “Hear” column and have them write at least two adjectives on their chart.

7. Ask the students to taste each slice of apple and describe what they taste. Write their adjectives on the poster under the “Taste” column and have them write at least two adjectives on their chart.
8. Ask the students to vote on whether they like red, green, or yellow apples best by choosing a red, yellow, or green interlocking cube. Stack the cubes together by color, and create a bar graph to show the preferences of the whole class.
9. Each student will choose adjectives from their *5 Senses Chart* to create a poem about apples. For each sense, they will write a sentence about the apples they were able to see, smell, feel, hear, and taste. Using the “Apple Book” template, cut a front and back cover and five pages. Write each sentence on one page of the book. Secure the book using a hole punch and ribbon.

Activity 2: Identifying Parts of an Apple

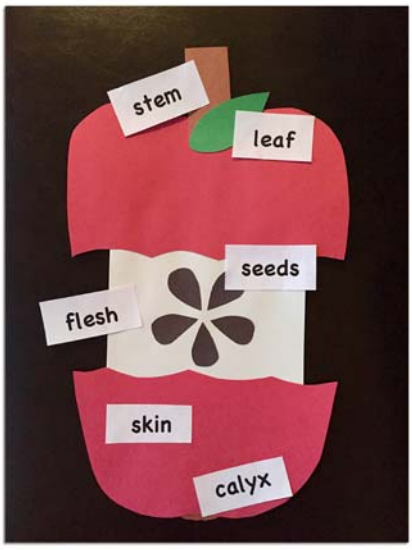
1. Prior to class, print and cut out one set of the *Apple Parts Cards* to use as labels throughout this demonstration. Explain to the students that they are going to learn about the different parts of an apple.
2. Cut an apple with an apple slicer. Peel the skin off of one slice. Ask students what it is. Explain that the skin covers and protects the apple’s flesh and seeds. Label the skin by placing it next to the “skin” card.
3. Show the students the peeled apple slice’s flesh. Explain that the flesh is the sweet part of the apple that you can eat. Place the flesh by the “flesh” card.
4. Pull the stem off of the apple core. Ask students what it is. Explain that the stem is what attaches the apple to the apple tree, bringing water and nutrients to the apple. Place the stem by the “stem” card.
5. Pull some seeds out of the core. Ask the students what they are. Explain that the seeds can be used to grow new apple trees. It takes a long time to grow a new apple tree from seeds. Place the seeds by the “seed” card.
6. Slice the bottom off of the core. Show the students the calyx. Explain that apples develop from flowers. The calyx is what is left of the apple blossom. Place the calyx with the "calyx" card.



Activity 3: Apple Model

1. Explain to the students that they will be making a paper model of the parts of an apple.

2. Show the students the example model. Point out each part reviewing what was taught in *Activity 2*. The skin covers and protects the apple's flesh and seeds. The flesh is the sweet part of the apple. The stem is what attaches the apple to the apple tree, bringing water and nutrients to the apple. The seeds can be used to grow new apple trees. The calyx is what is left of the apple blossom.



3. Give each student two pieces of either red, yellow, or green construction paper. Have them cut the top and bottom shape of an apple and bite marks on the straight lines to represent the apple's skin. Glue the colored papers on each end of the white rectangle, which represents the apple's flesh.
4. Glue the brown rectangle on top of the apple to represent the stem. Cut the green paper into the shape of a leaf and attach it to the bottom of the stem.
5. Cut a brown piece of paper to form the shape of a calyx and glue it onto the bottom of the apple.
6. The black paper can be cut into the shape of seeds and attached to the flesh of the apple.
7. Cut out the *Apple Parts Cards*. Read the cards together and have the students label each part of their apple by gluing the cards in place.

Activity 4: Making Applesauce

1. Before beginning this activity, students should wash their hands.
2. Explain to the students that apples are used to make apple juice, cider, vinegar, applesauce, and many different kinds of salads and desserts. Today they will be making and tasting homemade applesauce.
3. Explain the process of making applesauce to the students. Show the students the applesauce recipe, pointing out the ingredients list and directions.
4. The apples need to be peeled, cored, and sliced. Show the students how the apple peeler corer slicer works and which parts are sharp. Allow students to take turns using it to peel, slice, and core the apples.
5. Allow students to place the apples into a large slow cooker and mix in cinnamon and sugar. Several students can take turns mixing with a wooden spoon. Pour water and lemon juice over the apples. Cook on high for 3–4 hours until the apples are soft. Your classroom will smell wonderful!
6. When the apples are ready, allow students to take turns mashing the apples into applesauce using the potato masher. Give each student a cup of applesauce to taste.

Concept Elaboration and Evaluation:

After conducting these activities, review and summarize the following key concepts:

- Apples are a fruit that can be eaten fresh or after being made into applesauce, apple cider, or apple juice.
- Apples grow on trees.
- An area where apple trees grow is called an *orchard.*
- The five senses are sight, smell, hearing, touch, and taste.

Suggested Companion Resources

- Farm Pop-Ups (Activity)

  [https://learnaboutag.org/matrix/resources.cfm?rid=132]

- First Apple (Book)

  [https://learnaboutag.org/matrix/resources.cfm?rid=661]

- Bring Me Some Apples and I'll Make You a Pie (Book)

  [https://learnaboutag.org/matrix/resources.cfm?rid=414]

- Apples for Everyone (Book)
  [https://learnaboutag.org/matrix/resources.cfm?rid=348]
- The Apple Pie Tree (Book)
  [https://learnaboutag.org/matrix/resources.cfm?rid=349]
- How Do Apples Grow? (Book)
  [https://learnaboutag.org/matrix/resources.cfm?rid=317]
- From Apples to Applesauce (Book)
  [https://learnaboutag.org/matrix/resources.cfm?rid=310]
- Apples (Book)
  [https://learnaboutag.org/matrix/resources.cfm?rid=206]
- Up, Up, Up! It's Apple-Picking Time (Book)
  [https://learnaboutag.org/matrix/resources.cfm?rid=279]
- The Apple Orchard Riddle (Book)
  [https://learnaboutag.org/matrix/resources.cfm?rid=170]
- Apples (Multimedia)
  [https://learnaboutag.org/matrix/resources.cfm?rid=696]
- All About Apples (Website)
  [https://learnaboutag.org/matrix/resources.cfm?rid=664]

Sources/Credits

1. http://www.usapple.org/index.php?option=com_content&view=article&id=179&Itemid=285
2. http://www.nyapplecountry.com/about/fun-facts

Author(s)

Lynn Wallin

Organization Affiliation

Utah Agriculture in the Classroom

Pick-A-Peck
November - Kiwifruit

Five **Fun Facts** About Kiwifruit!

- In California, kiwifruit is harvested in the fall, making it in season from October through May.
- California farmers produce about 98% of the kiwifruit grown in the US.
- The kiwifruit originated in China and is also known as the Chinese gooseberry.
- Kiwifruit skin is completely edible and eating the skin triples the fiber intake compared to only eating the flesh.
- A serving of kiwifruit has more potassium than a banana.

Three **Fun Teaching Ideas!**

- Watch a video about California kiwifruit at **Kiwifruit.org**. Have students write down 5 facts they learned about kiwifruit, and then share and discuss their facts with a partner.
- Science experiment: Speed up the ripening process by placing one firm kiwifruit in a paper bag along with an apple. Leave an equally-firm kiwifruit in a separate bag. Compare the firmness of the two kiwifruits over time. This activity works with avocados too, so refer to the teaching resource in that section to learn more about how apples help other fruits (like avocados and kiwifruit) to ripen faster.
- Kiwifruit have “fuzzy” skin. Have the students come up with other, unique words to describe how the skin feels and tastes.

Explore all the great kiwifruit resources in this section!

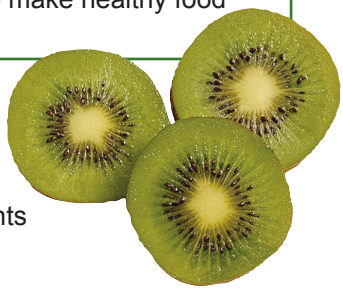
Learn About Ag®
California Foundation for Agriculture in the Classroom

Harvest of the Month

Network for a Healthy California

Health and Learning Success Go Hand-In-Hand

Supporting the health of students is essential for academic achievement. Eating nutrient-rich fruits and vegetables improves academic performance and increases cognitive functioning in undernourished children. *Harvest of the Month* connects with core curricula to give students the chance to explore, taste, and learn about the importance of eating fruits and vegetables. It links the classroom, cafeteria, home, and community to motivate and support students to make healthy food choices and be physically active every day.



Exploring California Kiwis: Taste Testing

What You Will Need:

- One whole and one peeled and sliced kiwi per two students
- Pencil and paper

Activity:

- Each student makes two columns on a sheet of paper, labeled whole and sliced. Create five rows and label: texture, look, smell, feel, sound, and taste.
- Feel the outside of the whole kiwi and record observations.
- Follow with the sliced kiwis and record observations.
- Compare and contrast the two columns.

For more ideas, reference:
School Foodservice Guide – Successful Implementation Models for Increased Fruit and Vegetable Consumption, Produce for Better Health Foundation, 2005, pp. 39–42.

Nutrition Facts

Serving Size: ½ cup kiwifruit, sliced (90g)

Calories 55	Calories from Fat 1
	% Daily Value
Total Fat 0g	0%
Saturated Fat 0g	0%
Trans Fat 0g	
Cholesterol 0mg	0%
Sodium 3mg	0%
Total Carbohydrate 13g	4%
Dietary Fiber 3g	11%
Sugars 8g	
Protein 1g	
Vitamin A 2%	Calcium 3%
Vitamin C 139%	Iron 2%

Cooking in Class: Kiwi Spears

Makes 30 tastes at 1 small spear each

Ingredients:

- 10-12 kiwis, peeled and sliced
- 5 tangerines, peeled and segmented
- 5 bananas, peeled and sliced
- Sturdy plastic straws, cut in half, or stir sticks
- Paper plates or napkins

1. Thread two slices each of kiwi, tangerine, and banana, in an alternating pattern, onto straws.
2. Serve one spear on a plate to each student.

Nutrition information per serving:
Calories 53, Carbohydrate 13 g, Dietary Fiber 2 g, Protein 1 g, Total Fat 0 g, Saturated Fat 0 g, Trans Fat 0 g, Cholesterol 0 mg, Sodium 2 mg

For more ideas, reference:
Kids Cook Farm-Fresh Food, CDE, 2002.

Reasons to Eat Kiwis

A ½ cup of sliced kiwis is:

- An excellent source of vitamin C* and vitamin K.
- A good source of fiber.
- A source of potassium, folate, beta-carotene, lutein, and zeaxanthin.
- One of the most nutrient-dense fruits.**

*Learn more about vitamin C on page 2.
**Refer to *Just the Facts* on page 2 for more information.

Champion Sources of Vitamin C*:

- Bell peppers
- Broccoli
- Citrus fruits
- Cantaloupe
- Cauliflower
- Kiwifruit
- Mustard greens
- Strawberries

*Champion sources provide a good or excellent source of vitamin C.

Source: www.nal.usda.gov/fnic/foodcomp/search (NDB No: 09148)

KIWIFRUIT

What is Vitamin C?

- Vitamin C helps the body heal cuts and wounds and helps lower the risk of infection.
- It also helps keep the body from bruising and helps build the tissue that holds muscles and bones together.
- Vitamin C is also known as ascorbic acid and helps the body absorb the iron found in foods.
- It is only found in plants.
- Vitamin C is a powerful antioxidant. These nutrients help protect cells from damage that can increase your risk for certain diseases, such as cancer.
- Vitamin C strengthens your immune system. However, research has not shown that high doses of vitamin C can prevent or cure the common cold.

For more information, visit:
www.eatright.org

How Do Kiwis Grow?

Kiwis grow on large, tender vines that can reach a height of 15 to 30 feet. The vine's shoots are thickly covered with reddish hairs and its large, heart-shaped leaves grow from six to nine inches long and up to eight inches wide. Due to the weakness of their vines, kiwis are commercially grown on sturdy support structures. From November to February, kiwi vines are dormant and must chill for about 600 to 850 hours at temperatures below 45 F. Vines are pruned during this time to help maintain production and regulate next season's crop yield and fruit size.

Budbreak in California generally occurs in mid to late March, depending on the growing location and weather conditions. By the time shoots have grown four to six inches long, all parts of the flower have been formed. The flower parts continue to expand until bloom, which usually starts in May.

Kiwi plants are dioecious, meaning individual plants are male or female. Only female plants bear fruit and only when pollenized by a male plant. They are typically planted in a vineyard at a ratio of about eight females to one male. Growers bring in bees during bloom so that the bees can move the pollen from the male to the female vines.

Following pollination, the fruit grows rapidly for the first 60 days and then slows until harvest. In California, where growing season temperatures are typically warm, 90 to 105 F, and summer rainfall is nonexistent, supplemental irrigation is necessary to achieve optimum kiwi growth and production. Peak water use on a hot summer day is about 10,000 gallons per acre.

Harvest begins in late September, with the majority of fruit harvested during October and early November.

Botanical Facts

Pronunciation: kē´wē-frōōt
Spanish name: kiwifruit or kiwi
Family: Actinidiaceae
Genus: *Actinidia*
Species: *A. deliciosa*

The kiwifruit is the edible fruit of the woody vine *Actinidia deliciosa* of the genus *Actinidia*. Although native to China, *A. deliciosa* spread to New Zealand in the early 20th century. Those who tasted the fruit thought it had a gooseberry flavor and began to call it the "Chinese Gooseberry." The fruit finally received its current name in 1959 when it was became a popular commercial product and an export company from New Zealand named it after the national bird, the kiwi.

In North America, it is commonly known as "kiwi," but it is marketed to the rest of the world as "kiwifruit." There are 400 varieties of kiwis, but Hayward is the most popular variety in the United States.

For more information, visit:
www.kiwifruit.org

Just the Facts

- Kiwis are one of the most nutrient-dense of all fruits.*
- Kiwis grow on vines that can be as high as 30 feet.
- Kiwis are actually a berry.
- The skin of a kiwi is edible. Try eating it whole like an apple!
- Kiwis contain an enzyme that acts as a natural meat tenderizer.

*The 1997 study examined the 27 most commonly eaten fruits and found kiwis to be the most nutrient-dense followed by papayas, mangos, and oranges.

For more information, visit:
www.calharvest.com/kinutr1.html

How Much Do I Need?

A ½ cup of sliced kiwis is about one medium kiwi. This is about the same as one cupped handful. The amount of fruits and vegetables that each person needs depends on age, gender, and physical activity level. Visit **www.choosemyplate.gov** to have students determine how many cups each of fruits and vegetables they need to eat every day. Have students write down their goals and track their food choices for all food groups using the MyPyramid Worksheet*.

*Download worksheet from
http://teamnutrition.usda.gov/resources/mpk_worksheet.pdf

Recommended Daily Amount of Fruits and Vegetables*

	Kids, Ages 5-12	Teens and Adults, Ages 13 and up
Males	2½ - 5 cups per day	4½ - 6½ cups per day
Females	2½ - 5 cups per day	3½ - 5 cups per day

*If you are active, eat the higher number of cups per day.
Visit **www.choosemyplate.gov** to learn more.

Cafeteria Connections

- Set aside a time each day to review the school menu with students and discuss why eating a variety of colorful fruits and vegetables is healthy for them. Ask students to identify the health benefits of specific fruits and vegetables on the menu.
- Have students keep records for a week of what meals are served in the cafeteria. Have them find out what fruits and vegetables are being served in the meals. Research where the fruits and vegetables are grown. Have students interview those responsible for buying food and determine how much, if any, is locally grown.

For more ideas, reference:
Fruits and Vegetables Galore, USDA, 2004.
www.nal.usda.gov/kids
www.agclassroom.org

School Garden: Giving Thanks

Have students write an essay or short story on the following:

- What does the garden give you for which you are thankful?
- What do you think it would be like if you had to grow all your own food?
- What do you notice that tells you winter is coming?

If interested in growing kiwis in your school garden program, visit:
www.fsa.usda.gov/ca
www.cfaitc.org
www.agclassroom.org

Student Sleuths

1. What is folate and what are the benefits of this B vitamin?
2. What is the difference between soluble and insoluble fiber? What are the benefits of each?
3. A study of the 27 most commonly eaten fruits found that the kiwi is the most nutrient-dense fruit. Why? What are the second and third ranked fruits?
4. Which enzyme makes the kiwi a natural meat tenderizer? What does it do?
5. Identify on a world map the countries where kiwis are grown.
6. Kiwis are available year-round in the United States. How does the growing and harvesting time compare to other kiwi-producing countries, like Chile and New Zealand? Is it different? Why or why not?
7. Research how the care of the kiwi vine and the importance of pruning are similar and different to that of other vine and tree fruits.

For more information, visit:
www.kiwifruit.org
www.thefresh1.com/kiwifruit.asp
www.fruitsandveggiesmatter.gov

Home Grown Facts

- California is the only state that commercially produces kiwis for the United States marketplace.
- California kiwis represent 95 percent of all kiwis grown in the United States.
- Approximately 8,000 acres are devoted to the production of kiwis in the United States.
- Kiwis were not widely available in California grocery stores until 1970.

For more information, visit:
www.kiwifruit.org

A Slice of Kiwi History

The history of the kiwi began in the Yangtse River valley in China, where it was called “Yang Tao.” The fruit Yang Tao was considered a delicacy by the court of the great Khans who cherished its delicious flavor and emerald-green color.

The first seeds were brought out of China by missionaries to New Zealand at the turn of the 20th century. They soon became a popular backyard vine. Kiwi plants were first exported to the United States in 1904, but it wasn’t until the 1960s when kiwis gained popularity in domestic markets.

- **1960:** Carl Heinke, the first commercial grower of California kiwi, planted nine Chinese Gooseberry vines in Paradise, at the request of his friend, Bob Smith. (Smith was employed by the U.S. Plant Introduction Gardens and was conducting research on Chinese Gooseberries in California to determine potential for their commercial production.)
- **1961:** The first New Zealand kiwi was sold at Trader Vic’s in San Francisco.
- **1962:** The first consumer request for kiwis occurred when a customer asked a local store for Chinese Gooseberries. Having never heard of them, the produce manager contacted produce dealer Frieda Caplan, who then began importing kiwis from New Zealand.
- **1966:** Smith gave kiwi seeds to George Tanimoto, a grower in Gridley who planted the seeds in a nursery.
- **1968:** Tanimoto transferred the vines to an acre of land.
- **1970:** Tanimoto’s vines yielded 1,200 pounds of kiwis. California kiwis found their way into the U.S. market when Caplan’s company, Frieda’s Fresh Produce, purchased Tanimoto’s entire harvest.
- **1977:** With the rise in popularity of the then-exotic kiwi, the Kiwifruit Growers of California was established.
- **1980:** The California Kiwifruit Commission was formed when both California and New Zealand kiwis became popular with French nouvelle/California cuisine.

Physical Activity Corner

As the winter holidays approach, students need extra support to stay healthy and focused in the classroom. Children should engage in at least one hour of physical activity every day to stay fit both mentally and physically. Play a different game or activity, like *Supermarket Face-Off,* each week in or out of the classroom.

Supermarket Face-Off

Objective:

Develops motor, listening, and team skills

Supplies:

- Play area (30 x 30 paces), divided in half
- Two "home" bases
- Four cones for boundaries (optional)

Preparation:

- Separate class into two teams: *Fruits* and *Veggies*.
- *Fruits* and *Veggies* face each other on opposite sides.

Activity:

- Call out the name of a fruit; *Fruits* run back to their base and avoid being tagged by *Veggies*.
- Call out the name of a vegetable; *Veggies* run back to their base and avoid being tagged by *Fruits*.
- If tagged, change to the team that tagged you.
- At end of game, see which items you have more of in your "shopping cart": *Fruits* or *Veggies*.
- *Variations:* Instead of calling out a fruit or vegetable, encourage careful listening by calling out "orrrrr-nament" (instead of "orange") or "bbbb-basket" (instead of "banana").

Go Farther:

Have students use different types of motor skills to get to their base (e.g., walk, run, skip, hop).

Bring It Home:

Encourage students to go to the grocery store with their family members to select fruits and vegetables to bring home to eat.

For more ideas, reference:

Community Youth Organization Idea & Resource Kit, Network for a Healthy California—Children's Power Play! Campaign,
www.cdph.ca.gov/programs/cpns/Pages/PowerPlayResources.aspx

Adventurous Activities

Field Trip:

Take students to a farmers' market. To find the location of a farmers' market in your area, visit **www.localharvest.org/farmers-markets**. Or, bring the field trip to the school. For more information on Farm to School programs, visit **www.farmtoschool.org/ca/**.

Science Investigation:

Cut a kiwi in half and have students compare how the inside looks like the iris of an eye.

History Exploration:

Have students research the various uses of kiwis throughout history and do a classroom presentation.

Creative Writing:

Using the facts learned from the Student Sleuths, have students interview their parents and friends to share their "Kiwi IQ."

Marketing Lesson:

Many fruits are sold by their variety, but kiwis are usually sold by the general name "kiwifruit" or "kiwi." Discuss with your class the reasons for the differences in the way kiwis are marketed in comparison to other produce.

For more ideas and information, visit:
www.ars.usda.gov/is/kids

Literature Links

National Children's Book Week

Invite school librarian to help you with this activity.

- Have students make drawings and write short stories featuring kiwis. Make copies of the stories, bind them into a book and give to the child nutrition and other school staff.
- "Swap" story books with another school participating in Harvest of the Month and share the new kiwi stories with your class or send to a local grocery store to display in the produce section.

For more ideas, reference:

School Foodservice Guide – Successful Implementation Models for Increased Fruit and Vegetable Consumption, Produce for Better Health Foundation, 2005, pp. 39-42.

For a list of book ideas, visit:
www.harvestofthemonth.com

This material was produced by the California Department of Public Health's *Network for a Healthy California* with funding from USDA SNAP, known in California as CalFresh (formerly Food Stamps). These institutions are equal opportunity providers and employers. CalFresh provides assistance to low-income households and can help buy nutritious foods for better health. For CalFresh information, call 1-877-847-3663. For important nutrition information, visit www.cachampionsforchange.net.

Pick-A-Peck
December - Citrus

Five **Fun Facts** About Citrus!

- The navel orange got its name because the button end resembles a belly button.
- Eating just one orange provides 100% of the recommended daily intake of Vitamin C.
- Moro or “blood” oranges are known for their burgundy color.
- Florida is the number-one producer of citrus fruits, and the majority of their crop is made into processed juice products.
- California is the leading producer of fresh citrus fruits (sold fresh rather than made into juice)!

Three **Fun Teaching Ideas!**

- Create a comic strip about the Asian citrus psyllid and California citrus trees. See the Asian Citrus Psyllid Fact and Activity Sheet.
- Bees are needed for citrus fruit to grow! Try the *Busy Bees* WE Garden activity to illustrate the role bees play in a fun and artistic way.
- Have students create a Venn Diagram comparing two citrus fruits. Make it a fruity-Venn, and draw fruit shapes instead of circles!

Explore all the great citrus resources in this section!

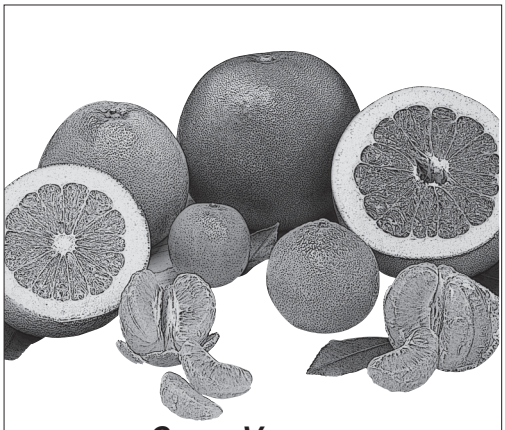
Learn About Ag®
California Foundation for Agriculture in the Classroom

Commodity Fact Sheet

Citrus Fruits

Information compiled by Sunkist Growers

How Produced – Citrus trees are propagated asexually through a procedure known as grafting which fuses two different varieties of plants. In the case of citrus trees, one variety, the rootstock, is selected for its hardiness and the other variety, the scion, is selected for its high-quality fruits. The rootstock, grown from a seed, is typically a two- to three-year-old seedling while the scion is a bud from a mature tree. Through grafting, the scion fuses to the rootstock and becomes a new tree. In approximately five years, the tree produces the same variety of fruit that was budded onto the rootstock. The successfully grafted trees are sold to citrus growers through wholesale nurseries and are certified disease-free. There are approximately 270,000 bearing acres of citrus trees in California.



Citrus Varieties

History – Oranges and lemons can be traced back to the ancient Middle East. In Sanskrit, the orange and lemon were called “Nagrunga” and “Nimbu” and their nectar was used both as a drink and as medicine. The Arabs called oranges “Naranji” while the Romans called them “Arancium.”

All navel oranges are related to each other and can be traced back to the Washington navel tree that still stands today in Riverside, California. Eliza Tibbets, a Riverside pioneer, is credited with planting California’s first two Washington navel trees in 1873. The resulting sweet seedless oranges helped launch Southern California’s modern citrus industry.

Varieties – Citrus fruits of one variety or another are available year-round from California, Arizona, and Florida. Navel oranges, a consumer favorite, are sweet, seedless and easy to peel. They are winter oranges, available November through May, and derive their name from their distinctive “button end.” Cara Caras are a type of Navel orange which is available December through April. They have a rich pink pulp, are naturally sweet, low in acid and seedless. Valencia oranges, which are excellent for juicing as well as for eating fresh, are summer oranges available February through November. California also produces Moro and Sanguinelli “Blood” oranges, named for their burgundy flesh.

Traditional lemons, such as the Eureka and Lisbon varieties, are a California classic and available all year long. They have a tart juice and a zesty peel. Traditional lemons are not typically eaten as a whole fruit but are wonderful flavor enhancers. Meyer lemons have a golden peel and, as a cross between a mandarin orange and a lemon, are less acidic than traditional lemons.

Desert grapefruit are harvested October through March while summer grapefruit are available May through September. Specialty citrus include Melo Golds and Oro Blancos, grapefruit varieties that are popular with those preferring a sweeter taste. Pummelos, or “Chinese” grapefruit, considered a delicacy among many Asian cultures, are the largest of all citrus fruits.

Almost a dozen different mandarin and tangerine varieties, such as Clementines, Gold Nuggets, and Pixies, are available November through May. Most are easy to peel and have a lively flavor.

Commodity Value – While Florida is the number one producer of citrus fruits, the majority of their crop is made into processed juice products. California ranks second in the nation in total citrus production and is the leading producer of fresh citrus fruits. Both oranges and lemons are among the top 20 commodities produced in the state as listed by the California Department of Food and Agriculture. Oranges and their products are also one of California’s leading agricultural exports. Canada is the top importer with Korea, China, and Japan following closely. Lemons are also a high value export crop. Japan is the largest importer of California lemons.

Top Producing Counties – Most of the nation’s fresh citrus products are produced in California and Arizona. The ideal climate in these areas permits the growth of fruit that is as pleasing to the eye as it is to the taste. The leading counties in California citrus production include Tulare, Kern, Fresno, Ventura, and San Diego.

Nutritional Value – Citrus is well known for its high vitamin C content. In fact, just one orange supplies a full day’s requirement. Vitamin C, also known as ascorbic acid, is required for strong gums and healthy body tissues and for preventing a disease called scurvy. Oranges, lemons, grapefruit, and tangerines are great tasting, low calorie foods which are good sources of carbohydrates and fiber, and are low in sodium, cholesterol, and fat. Cara Cara “Power Oranges” are packed with vitamin C, A, fiber, and are a natural source of lycopene.

For additional information:
Sunkist Growers
Website: www.sunkist.com

02/19 Learn About Ag

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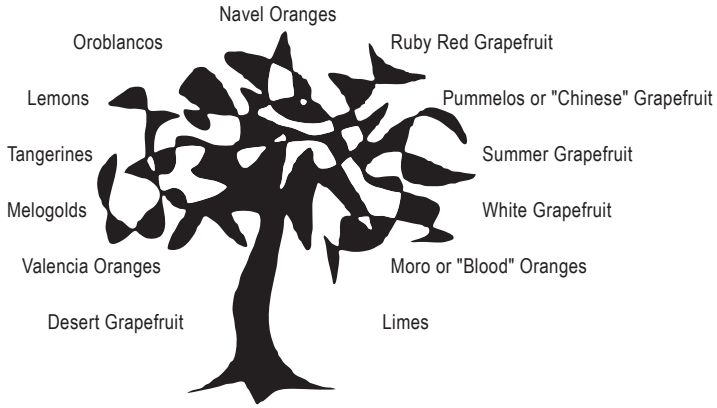
Citrus Fruit Activity Sheet



Citrus Varieties

Availability of Citrus Varieties by Month

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
ORANGES												
NAVEL ORANGE	■	■	■	■	■						■	■
VALENCIA ORANGE		■	■	■	■	■	■	■	■	■		
CARA CARA ORANGE	■	■	■	■								■
MORO ORANGE	■	■	■	■								■
GRAPEFRUIT												
WESTERN GRAPEFRUIT	■	■	■	■	■	■	■	■	■	■	■	■
PUMMELO	■	■	■	■	■					■	■	■
ORO BLANCO	■									■	■	■
SWEETIE		■	■	■								
MELO GOLD	■	■										■
TANGERINES												
DANDY TANGERINE	■											
FAIRCHILD TANGERINE	■									■	■	■
MINNEOLA TANGELO	■	■	■	■								■
CLEMENTINE MANDARIN	■										■	■
ROYAL MANDARIN	■	■	■									

Lesson Ideas

- Test the pH of a citrus variety and two non-citrus fruits. Create a hypothesis and compare your findings.
- Experiment with the effect lemon or lime juice has on cut avocados or apples. Explain the significance of pH and enzymes in cut fruit preservation.
- Use the citric acid of a citrus fruit to create electricity.
- Make orange, lemon, or grapefruit juice popsicles.
- Make a bar graph comparing the vitamin C content of different fruits, including citrus fruits.
- Observe and practice various grafting techniques used in growing citrus trees.
- Perform experiments that show the effects of freezing on citrus fruits.
- Compare the climates of different citrus growing regions of the world.
- Determine the percentage of water in a citrus fruit.
- Measure and graph the peel to fruit weight ratios of several different citrus fruits.

Fantastic Facts

1. Citrus fruit trees are reproduced by grafting.
2. Meyer lemons are known for being less acidic and golden in color.
3. All citrus fruits have high quantities of vitamin C.
4. The navel orange got its name due to the button end resembling a belly button.
5. California and Arizona produce most of the United States' fresh citrus fruit.
6. Florida produces the most citrus fruit.
7. One orange contains 100 percent of a person's recommended daily intake of vitamin C.
8. Moro and Sanguinelli orange varieties are known for their burgundy colored flesh.

Lesson Plan: What's Inside?

Introduction: From pummelos to pixies, citrus fruits come in a wide range of sizes. They also differ in quantity of segments, presence of seeds, and volume of juice.

Objective: Students will examine a variety of citrus fruits. They will estimate and then measure the quantitative characteristics of the fruit.

California Standards: CC Math: 3-4.MD.2,4; 5.MD.2; 6.SP.4; HS.N-Q.1,2,3

Materials: A variety of whole citrus fruits (oranges, limes, grapefruit, lemons and tangerines), knife, paper towels, juicer (optional), string, ruler, balance, crayons.

Procedure:

1. Have students predict how many segments and seeds they will see when the fruits are cut cross-wise. Plot the estimates on a graph. Use unit fractions as appropriate.
2. Weigh each fruit whole and record the results. Measure the circumference using a string and a ruler. Plot the results on a graph.
3. Cut the fruit cross-wise and count the number of segments and seeds. Record and chart the results and compare to the estimates.
4. If seeds are present, remove and dry for planting at a later date.
5. Use the juicer to remove the juice from the fruit. Reweigh the citrus halves to determine the juice content of the citrus fruit. Plot the fruit weight and juice weight on a graph.
6. Mix the juices to make a citrus drink for the class to enjoy.

02/19 Learn About Ag

This Fact and Activity Sheet was developed by California Foundation for Agriculture in the Classroom in conjunction with California educators and meets the required education standards of the California Department of Education.

11 INVESTIGATING THE POLLINATION CYCLE

Busy Bees

Fruit trees must be pollinated to produce fruit. Pollen grains are transferred from the male flower part to the female flower part by wind, water, birds, bees and other insects. Bees are attracted to the nectar and pollen of fragrant flowers. The bee stops at a flower to suck the nectar, and the pollen grains get stuck to the bee's body. When the bee moves to another flower, the pollen grains are transferred to the second flower. More than 80 percent of crop pollination is accomplished by bees.

1. Write the following journal prompt on the board: "Do you think bees are helpful or harmful? Describe." After students brainstorm and write their answers down, ask them to share with the class.

2. Distribute green paper plates and craft supplies. Instruct students to illustrate and narrate the pollination cycle of bees on the paper plates. Use yellow pom-poms to depict the bee. Each quadrant of the plate should explain a different step of the pollination cycle:

   a. The bee is looking for food.
   b. The bee lands on the flower and sips the nectar. Pollen gets stuck on its body.
   c. The bee flies away, looking for more food.
   d. The bee lands on a new flower with pollen from the last flower. The pollen is transferred.

3. Use brown construction paper to create a tree trunk. Attach to the bottom of the plate with tape.

4. Ask each student to explain the pollination story to a partner using their completed visual aid.

Objective: Students will identify each step of the pollination cycle and understand the importance of bees in agriculture

California Standards

Kindergarten: ELA CC: SL.K.1,5
NGSS: K-LS1-1, K-ESS3-1

Grade 1: NGSS:1-LS1-1

Grade 2: ELA CC:SL.2.1,5
NGSS:2-LS2-2

Grade 3: ELA CC: SL.3.1,5
NGSS:3-LS1-1, 3-LS2-1

This lesson can be easily adapted to meet the educational standards for a variety of grade levels.

Materials:

- Green paper plates
- Circle template, divided into quadrants
- Brown construction paper
- Crayons, colored pencils or markers
- Tape
- Yellow pom-poms

Vocabulary:

Nectar: a sweet liquid for pollinators that is produced by flower glands called nectaries.

Pistil: the female part of the flower including the stigma, style and ovary.

Pollen: the fine, powder-like material produced by the anthers of flowering plants.

Pollen basket: a smooth, slightly concave surface of the outer hind leg of a bee that is fringed with long, curved hairs that hold the pollen.

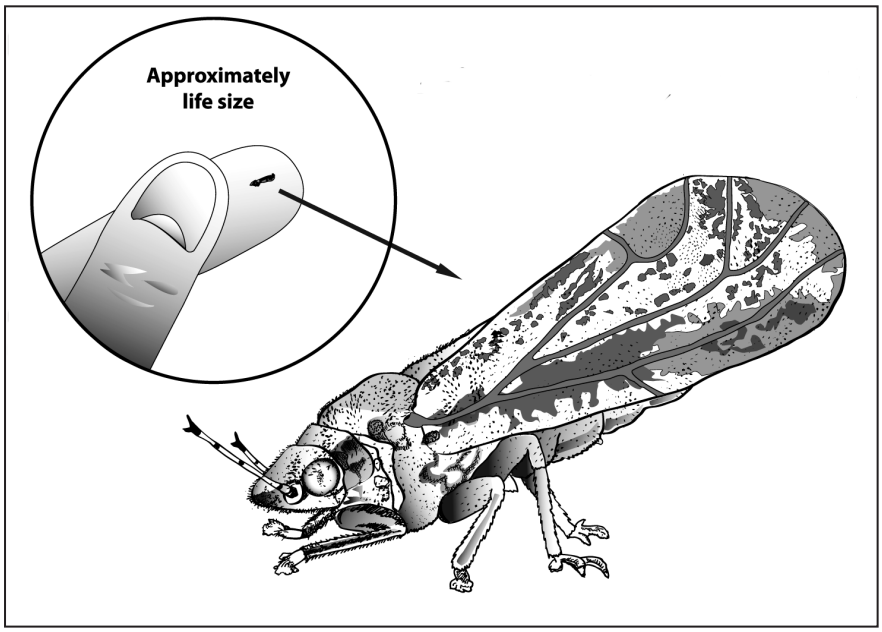
Stamen: the male part of the flower consisting of the anther and filament.

This lesson has been adapted from Virginia Agriculture in the Classroom curriculum. For additional educational resources, visit *AgInTheClass.org*.

Invasive Species Fact Sheet

Asian Citrus Psyllid

Description: A tiny bug called the Asian citrus psyllid is a big problem for citrus growers, home gardeners, and anyone who enjoys eating citrus. The Asian citrus psyllid threatens all citrus varieties and a few ornamental plants, because it can transfer a bacterium that causes huanglongbing [hwang-long-bing] (HLB) disease, also known as "citrus greening disease."



The Asian citrus psyllid adult is as small as a sesame seed and has mottled brown wings. When the adult feeds it tilts its hind end at a 45-degree angle, making it look like a thorn on leaves and stems. Female Asian citrus psyllids lay hundreds of eggs in their lifetime, usually on new shoots and leaves. Asian citrus psyllid juveniles, or nymphs, are yellow in color and produce sugary 'honeydew' from the plant liquids they eat. Waxy, white tubules can be seen extending from their hind ends to move honeydew away from their bodies so they don't drown in it.

Habitat: The Asian citrus psyllid and HLB came from southern Asia and citrus psyllids were first discovered in North America, in Florida in 1998. The Asian citrus psyllid has since spread through parts of the United States and Mexico. HLB is also gradually spreading along with the psyllid. Psyllids feed on leaves and stems of all citrus varieties.

How Asian citrus psyllid and HLB are spread: The Asian citrus psyllid spreads by flying from citrus tree to citrus tree and HLB spreads when an Asian citrus psyllid picks up the bacteria by feeding on an infected plant, then flies to another plant and feeds again. Psyllids can travel long distances when people transport infested plants or plant debris from one area to another. This can lead to infestations in entirely new regions or states.

Why it is a problem: The Asian citrus psyllid is dangerous because it can infect citrus trees with the bacterium that causes HLB, the worst citrus disease in the world. There is no cure for the disease and infected trees will eventually die. Homeowners and farmers must remove and destroy infected trees to prevent further spread of the disease.

HLB has killed many citrus trees in Asia, India, parts of the Middle East, South America, and Florida, and is now threatening citrus production in California, which is a $2.1 billion industry. California produces 87% of the nation's lemons, and 80% of California's oranges are sold in the U.S.

How it affects California specialty crops: Many of the affected crops are California specialty crops. Specialty crops are fruits and vegetables, tree nuts, dried fruits, and horticulture and nursery crops (including floriculture). Many of the fruits, nuts, and vegetables eaten in the United States are grown right here in California. The Asian citrus psyllid could destroy these citrus crops including orange, lemon, lime, mandarin, kumquat, and grapefruit.

How you can help: Only purchase citrus trees from a good nursery close to your home and do not transport citrus trees to other areas. Anyone with citrus trees should inspect young leaves whenever watering or pruning. Always bag or dry out citrus prunings before disposing of them so psyllids don't hitch a ride to new places. Before transporting fruit, remove stems and leaves to make sure there are no psyllids. If an Asian citrus psyllid is found, report it to local agriculture authorities.

For Additional Information:
California Department of Food and Agriculture
1220 N Street
Sacramento, CA 95814
Pest Hotline: (800) 491-1899
www.cdfa.ca.gov/plant/acp
www.californiacitrusthreat.org

07/19

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Email: info@learnaboutag.org Website: www.LearnAboutAg.org

Asian Citrus Psyllid Activity Sheet

Asian citrus psyllid nymphs can be identified by the waxy tubules that they secrete.

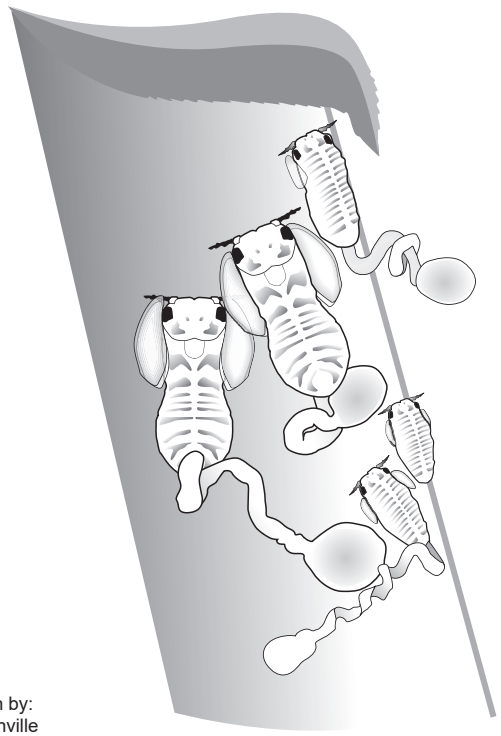

Illustration by:
Gwen Conville

Fantastic Facts

1. What is the Asian citrus psyllid?
2. What does the Asian citrus psyllid adult look like on leaves and stems?
3. How do you cure trees infected with huanglongbing disease?
4. What percentage of fresh oranges sold in the U.S. are grown in California?
5. Name two things you can do to help stop the spread of Asian citrus psyllid.

1) A tiny insect that threatens citrus 2) A thorn 3) No cure 4) 80% 5) Buy local plants, inspect citrus fruit and trees, wipe off fruit and remove leaves and stems, bag or dry out green waste

Lesson Ideas

- Create a comic strip featuring the Asian citrus psyllid and its destruction of citrus.
- Research the latest psyllid appearances and mark on a map how close the psyllid is to your home.
- Write a persuasive essay on the importance of keeping pests like the psyllid out of California.
- In groups, create a psyllid model out of recycled materials. Give each creation a creative name.

Lesson Plan: Stop the Psyllid

Introduction: To understand the economic impact of Asian citrus psyllid and huanglongbing disease, students will act as citrus growers managing a navel orange farm. ACP and HLB will be introduced into the orchard and students will calculate the point at which their orchard is no longer profitable.

Materials:

- You Tube Video: “Deadly Huanglongbing Disease Threatens California Citrus” www.goo.gl/vUczj6
- You Tube Video: “Detecting Asian Citrus Psyllid” www.goo.gl/sD3ccM
- Paper, colored pencils

Procedure:

1. Play both videos and discuss psyllid identification and damage caused by HLB disease.
2. Have students pair up to be “farmers” who own a 100-acre orange farm.
3. Project the template found at www.LearnAboutAg.org/factsheets/invasivespecies. Students should use this template to draw their own chart to show what’s happening in the citrus orchard at each stage of ACP infestation.

Chart boxes should be large enough for students to draw a picture of the orchard and write down the costs associated with ACP and HLB.

4. Students should use the following information to predict when the citrus farm is no longer profitable:
    - Trees take at least 5 years to start producing fruit.
    - HLB disease takes several years to start affecting fruit production. It can kill a tree in about five years. Diseased trees must be removed.
    - There are 100 trees per acre in the orchard
    - Profit per acre = $2,500 ($25/tree)
    - Annual cost of pesticides to control ACP = $500/acre applied every year after ACP has been detected
    - Tree replacement costs = $25/tree
    - At what point is it no longer profitable to farm citrus?
5. Why is it important to stop the spread of Asian citrus psyllid and HLB?

07/19

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Email: info@learnaboutag.org Website: www.LearnAboutAg.org

Pick-A-Peck

January - Almonds, Pistachios & Walnuts!

Five **Fun Facts** About Nuts!

- Walnuts are the oldest known tree food.
- Almonds, pistachios and walnuts are harvested using machines called shakers that shake the nuts out of the trees.
- More than 98% of the world's almonds and pistachios come from California. About two-thirds of the world's walnuts are grown in California.
- Almond trees are related to peach trees and rose plants.
- Nearly 50% of California-grown pistachios are exported.

Three **Fun Teaching Ideas!**

- Have students complete the *Let's Graft* worksheet and crossword puzzle, and learn about the importance of grafting to grow walnuts.
- Find out *What's Growin' On?* with nuts! Check out the pages about almonds, pistachios and walnuts!
- Go nuts with almonds and walnuts! We offer a free five-lesson unit (grades 3-5) all about California almonds. The resources includes a video and student workbook. We also offer a total of three lesson plans about California walnuts, geared for grade levels 2-8. Find these free resources and more at **LearnAboutAg.org/lessons**.

Explore all the great almond, pistachio and walnut resources in this section!

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California Foundation for Agriculture in the Classroom

Commodity Fact Sheet

Almonds

Information compiled by the Almond Board of California

How Produced – Following the winter dormant season, early spring weather coaxes the first almond blossoms from their buds. Because the trees are not self-pollinating, at least two varieties of almond trees are planted in alternate rows in each orchard. Almonds grow best when the weather from February onward is frost-free, has mild temperatures, and minimal rain so blossoms can flourish and bees can cross-pollinate the blossoms. After the petals have dropped and the trees have leafed out, the first signs of the fuzzy gray-green fruit appear. The hulls that cover the growing almonds continue to harden and mature. In July, the hulls begin to split open. Between mid-August and late October, the splits widen, exposing the shells, which allow the almond kernels to dry. The whole nuts eventually separate from their stems and the hulls open completely.

Before harvest, orchard floors are swept and cleared. Mechanical tree shakers knock the almonds to the ground, where they are allowed to dry before they are swept into rows and picked up by machine. They are transported to carts and towed to the huller, where the hull is removed.

The almonds are packaged raw, roasted, or flavored. Some varieties are prepared into various forms including sliced, diced, slivered, ground (almond flour), blanched, as pastes, and as butters.

History – Almonds are mentioned far back in history, even in the Bible. They were a prized ingredient in breads served to Egyptian pharaohs. The ancestry of the almond is unknown, but almonds are thought to have originated in the Mediterranean area of Europe. Explorers ate almonds while traveling the Silk Road between the Mediterranean, Central Asia, and Eastern Asia. Before long, almond trees were being enjoyed by many different cultures, from China to India and beyond.

The almond tree was brought to California from Spain in the mid-1700s by Franciscan Padres. However, the moist, cool weather of the coastal missions did not provide optimum growing conditions. It was not until the following century that trees were successfully planted inland. By the 1870s, research and cross-breeding had developed several prominent almond varieties. By the turn of the twentieth century, almonds were firmly established in the Sacramento and San Joaquin areas of California's Central Valley.

Varieties – Almond growers have sought to produce delicious varieties that would be hearty in the fields and work well as a cooking ingredient. Research in the 1870s resulted in some of today's varieties including Mission, Price, Carmel, and today's most popular, the Nonpareil. Since then, more than 40 varieties have been developed and grown commercially. Most research today focuses on developing varieties that are more resistant to crop damaging insects. Almonds are related to the peach and rose families. In fact, most almond trees are grafted to peach rootstock, which is more resistant to pests.

Commodity Value – California produces the largest supply of almonds in the world. With more than 6,000 growers and 100 almond processors, California produces approximately 80 percent of the world's almonds and 100 percent of the United States commercial supply. The United States is the largest consumer of almonds. Spain is the largest importer of California almonds importing more than 153 million pounds in 2014-15. More than 90 countries import California almonds, including Spain, China, Germany, India, United Arab Emirates, Japan, Canada, Turkey, the Netherlands, and Italy.

Top Producing Counties – The largest almond-growing region of the world is California's Central Valley, an area stretching nearly 500 miles. Its hot, dry summers and cool, wet winters make it an ideal location for growing almonds. Top producing counties include Kern, Fresno, Stanislaus, Merced, and Madera.

Nutritional Value – Almonds are an excellent source of vitamin E and magnesium. Studies have shown that almonds can actually lower cholesterol levels. A handful (one ounce, about 23 almonds) has the same amount of calcium as one quarter cup of milk and the same amount of fiber as an apple or orange. Almonds are also a good source of protein and are listed in the "meat, eggs, poultry, fish, dry beans, and nuts" category of MyPlate which recommends that most nine to 18-year-olds should eat five to six ounce equivalents from this category each day.

For additional information:
Almond Board of California
(209) 549-8262
Website: www.Almonds.com

california almonds®

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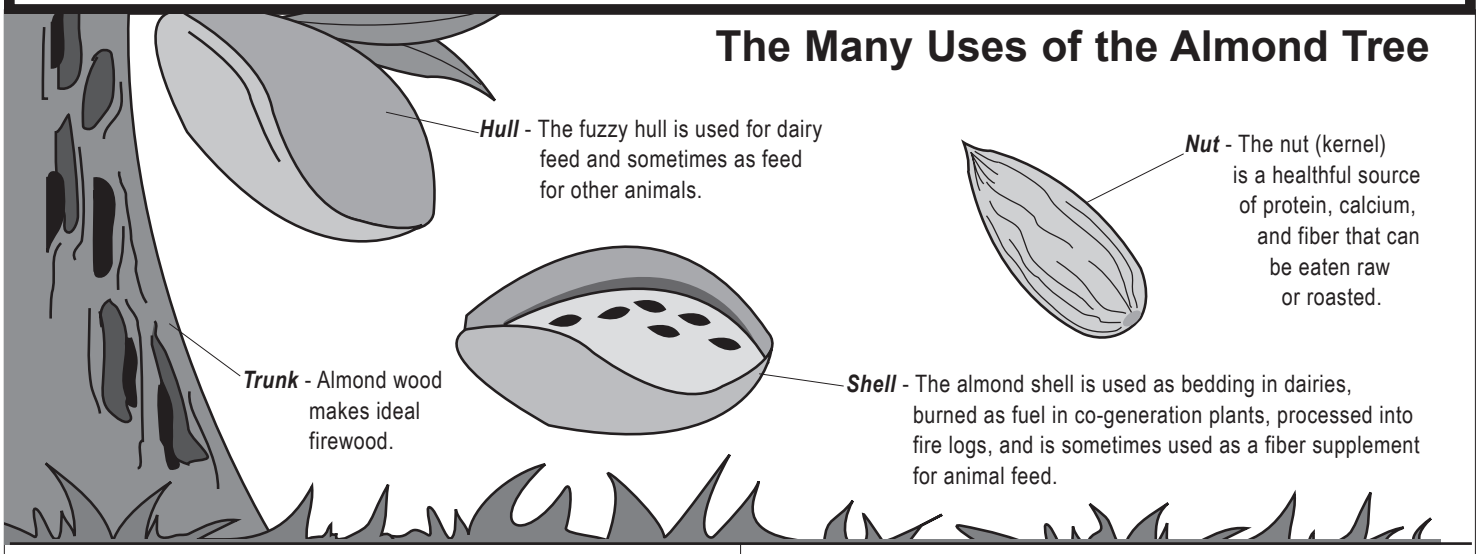
Email: info@learnaboutag.org • Website: LearnAboutAg.org

Almond Activity Sheet

The Many Uses of the Almond Tree



Lesson Ideas

- Visit your local market and see how many different almond products you can find.
- Examine the nutritional labels for almonds and milk. Create a graph comparing the nutritional value of the two. Remember to use equivalent serving sizes.
- Investigate which countries import California almonds. Identify the locations on a map and illustrate the flow of goods.
- Taste test a variety of almonds including raw, roasted unsalted, and roasted with salt or other flavors.
- Study the process of cross-pollination and learn how it is used in the almond industry.
- Create a mural or book about the life cycle of an almond tree.
- Create recipes using almonds. Make a class "Almond Cookbook."
- Study the scientific processes involved in the blanching (removing the skin) of almonds.

Fantastic Facts

1. Peaches and roses are related to the almond.
2. Dairy feed is one use of the fuzzy almond fruit.
3. Almond trees did not become a staple tree at California missions because the coastal climate was too mild for optimal production.
4. A mechanical shaker removes almonds from trees.
5. At least two varieties of almond trees are planted in almond orchards because almonds must cross pollinate.
6. Non-pareil is the most popular variety of California almond.
7. Almonds have calcium that is important for strong bones and teeth.
8. California produces 100% of United States almonds.

Lesson Plan: A Look at the Nutrients of an Almond

Introduction: Almonds contain five of the six classes of required nutrients—carbohydrates, fats, protein, fiber, vitamins, and minerals. Your students will examine the nutrition information of whole-shelled almonds and learn about the nutrients they provide to the human body.

Objective: To study the role nutrients play in growth.

California Standards: CC ELA: RI.3-5.3, W.3-12.7, RST.6-12.1 NGSS: 3-LS1-1, 5-PS3-2; MS-LS1-7; HS-LS1

Materials: One pound package of whole uncooked almonds with nutrition label, one almond in shell for each student, construction paper, markers, nutrition reference books or encyclopedias.

Procedure:

1. Distribute one almond with a shell and one almond without a shell to each student. Have students make observations of the shell and discuss its uses. Have students compare their two almonds. Are they the same varieties or do they appear different? Discuss the varieties of almonds, their uses and the cross-pollination needed to produce almonds.
2. Have each student observe the nutrition label for one serving of almonds.
3. Assign pairs of students one of the nutrients contained in an almond and research the human body's need for that particular nutrient.
4. Create a class book showing how these nutrients assist the human body to grow, repair, furnish energy, and regulate body processes. Incorporate artistic techniques, word processing, use of the Internet, library research, and group problem solving.

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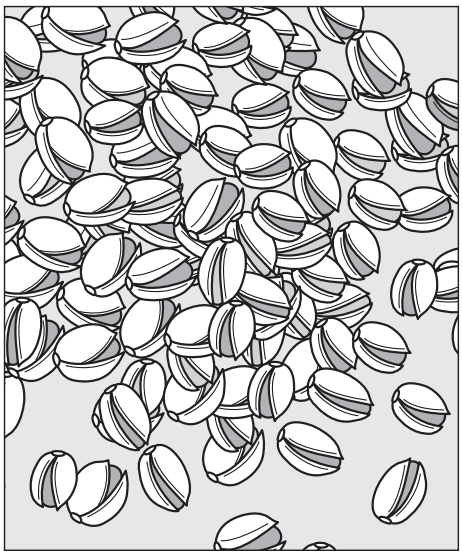
Commodity Fact Sheet

Pistachios

Information compiled by the Administrative Committee for Pistachios

How Produced – Pistachio trees often begin in the nursery where rootstock seeds are planted, germinated, and grown in pots for 15 months. In recent years, some rootstock trees are grown clonally in sterile cultures inside a laboratory before being grown in a greenhouse. The rootstock is then planted in an orchard to help the tree adapt to soil, climate, and other environmental conditions, before being budded with an edible cultivar (variety). It takes approximately six years after the tree is planted in the orchard before the first harvest. Pistachio trees are either male or female and the pollen is distributed throughout the orchard by the wind. Trees need long, hot, dry summers, and moderately cold winters for optimum yield.



Like other nut trees, the pistachio is alternate bearing—producing a heavy crop one year and a lighter crop the next. Trees reach maturity and peak production after approximately 15 years. In the Middle East, pistachio trees have been known to produce for more than 100 years.

Pistachio nuts grow in grape-like clusters and an outer skin, called the hull, encases each nut. When ripe, the hull turns rosy and the inside shell splits naturally, indicating the nut is ready to be harvested. Harvest usually begins in early September and continues for four to six weeks. California pistachios are mechanically shaken from the tree (in under a minute) and fall directly onto a catching frame. At the processing plant, workers use machines to remove the hull and dry the nut within 24 hours after harvest, ensuring the highest quality standards. Technological advances continue to improve sorting and grading techniques. For example, electric eyes detect any dark-stained shells and blow them away in a jet of air. Further processing may include roasting, salting, and dying the nut red to meet consumer demand. More than 90 percent of the pistachios sold are roasted and salted.

History – Pistachios are native to the low mountains and barren, dry foothills in the elevated deserts of Afghanistan, Iran, and Turkey. Historically, they were considered a rare delicacy and a favorite of the Queen of Sheba.

Pistachios were imported to America in the 1880s but did not become popular as a snack food until 50 years later. These nuts were dyed red to draw consumer attention and to cover stains from now obsolete harvesting techniques. The California pistachio industry can be traced back to 1930 with experimental plantings by American plant scientist William E. Whitehouse, who returned from a six-month trip to Persia (modern day Iran) with 20 pounds of the most distinctive seed he could find. The first commercial crop in California was not harvested until 1976, producing 1.5 million pounds of pistachios.

Varieties – California pistachios are of the Kerman cultivar, which originated from seed found in the Kerman region of Iran. Since the state's first plantings, scientists have strengthened the Kerman cultivar by budding it to healthier rootstocks. Several new varieties have been released and are being evaluated. The two most widely planted new varieties include Lost Hills and Golden Hills. They are harvested earlier than the Kerman variety and can thrive in warmer climates.

Commodity Value – California leads the nation in pistachio production - it is the sole producer (99% or more) of pistachios. In 2015, 233,000 acres produced 135 million pounds of pistachios and provided California farmers with more than $669 million in returns. In 2015, total export value of pistachios was $848 million. Major destinations for export of pistachios were Europe, China, and Canada.

Top Producing Counties – Kern County leads the state in pistachio production with 27 percent of total state sales, followed by Tulare County with over 23 percent. Other top producing counties include Madera, Fresno, and Kings.

Nutritional Value – California pistachios provide high-energy nutrients. Each one-ounce serving of shelled pistachios (49 kernels) offers 300 milligrams of potassium, six grams of protein, nine grams of total carbohydrates, and three grams of dietary fiber. Pistachios are relatively high in monounsaturated fats (seven grams per serving), which scientists say assist in maintaining good (HDL) cholesterol, while reducing the bad (LDL) cholesterol levels and polyunsaturated fats (four grams per serving). Pistachios have just 1.5 grams of saturated fat per serving, no trans fat, and like all nuts, pistachios contain no cholesterol.

For additional information:
Administrative Committee for Pistachios
(559) 255-6480
Website: www.acpistachios.org

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Email: info@learnaboutag.org • Website: LearnAboutAg.org

Pistachio Activity Sheet

The Historical Development of the California Pistachio

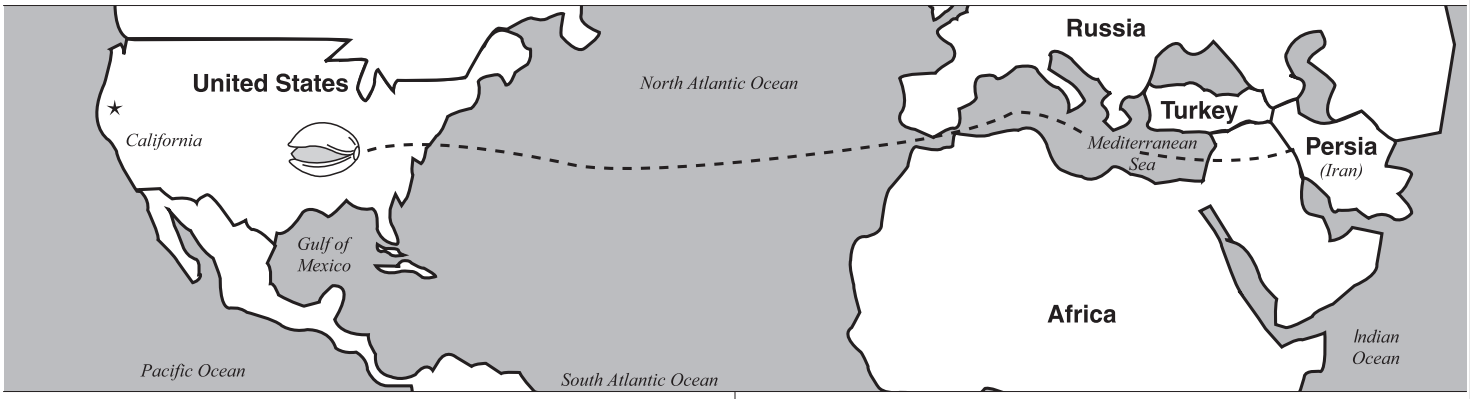
1929—William E. Whitehouse, as instructed by Knowles Ryerson, entered Persia (Iran) to obtain pistachio seeds.

1929-1930—Whitehouse explored Persia and collected 20 pounds of individually selected pistachio seeds, which he took to Washington, D.C.

1930-1950—3,000 trees grew from 20 pounds of seed. However, only one tree proved to be useful.

1950s—The successful pistachio tree seeds were named Kerman for the famous carpet-making city near Rafsanjan in Iran.

2010—More than 550 million pounds of California pistachios were marketed for a value of more than $1.4 billion.



Lesson Ideas

- Create a timeline showing when pistachios were introduced in California and the events that occurred before commercial production began.
- Create a map of California highlighting the major counties where pistachios are grown. Compare and contrast the growing conditions in these counties to the Kerman region of Iran.
- Explore how other countries use pistachios.
- Make pistachio butter. Have a taste test with other homemade nut butter (peanut, walnut, almond).
- Make pistachio creatures. Write a story about your creature.
- Create a flow chart of the life cycle of pistachios.
- Create and prepare a recipe using pistachios.
- Compare the buoyancy of closed and opened pistachios. Discuss how this principle is used in sorting nuts.

Fantastic Facts

1. Pistachio production requires long, hot summers, cold winters, and a breezy spring.
2. It takes 12-24 hours to hull and dry pistachios.
3. California produces 99 percent of the United States' pistachio crop.
4. The first commercial crop of pistachios in California was not harvested until 1976.
5. It takes 20 years for a pistachio tree to reach peak production.
6. Pistachios resemble grapes while growing on a tree.
7. Approximately 65 percent of California pistachios are exported.

Lesson Plan: Let's Compare!

Introduction: The agricultural production and economic impact of commodities varies from state to state and country to country.

Objective: Students will compare the production, nutritional philosophy, and economic impact of the pistachio in the Mediterranean to that of the United States.

California Standards: CC ELA: W.3-12.2, W.3-12.7, SL.3-12.4, SL.4-8.5

Materials: World map, access to reference books, encyclopedias, and the Internet, chart paper, markers.

Procedure:

1. Gather various resources students can use in the lesson described below.
2. Discuss with the students that different cultures throughout the world have different eating habits and varying agricultural practices due, in part, to climate, technological advances, and economics. Locate the Mediterranean region on the map.
3. Divide the students into three groups. Each group will compare and contrast the United States to the Mediterranean in one of the following areas:
    - Pistachio production, processing, and harvesting techniques
    - Economic impact of pistachios, including importing and exporting policies and procedures.
    - USDA MyPlate and Mediterranean Diet Pyramid, which vary in the quantities of recommended daily consumption within the various food groups.
4. After the students have gathered information related to their topic, have them write a multi-paragraph report and create a related visual aid. They should use chart paper and markers to make a visual, which can be displayed for others to learn from.
5. Have students share their projects with the class. Take this opportunity to discuss that there are many ways to complete a task or look at subjects such as nutrition.

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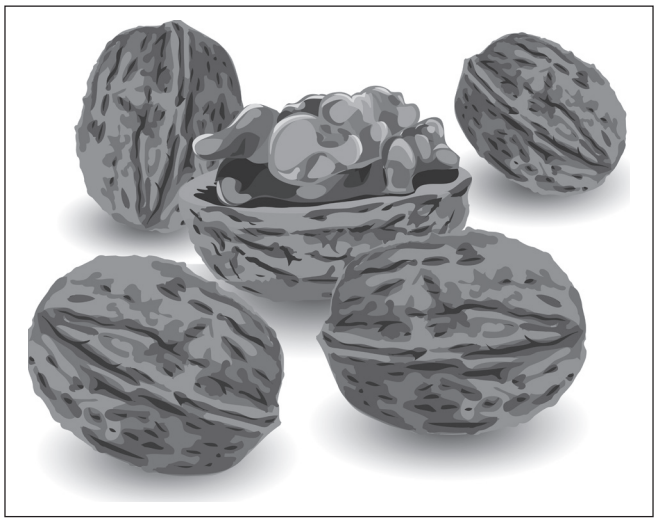
Commodity Fact Sheet

Walnuts

Information compiled by the California Walnut Board

How Produced – After an orchard is planted, it takes approximately four years until it produces its first major crop. Constant attention is given to each tree every step of the way—from pruning, spraying, and fertilizing to irrigation—to ensure a healthy orchard. Once a walnut tree has been planted and stabilized, it will continue to bear fruit for as long as a century.



Harvest begins in September when the protective outer covering, called a hull, splits, signaling that the nuts are ready to be removed from the trees. Nuts are often harvested by a mechanical shaker. After walnuts have been shaken to the ground, they are blown into a row to allow mechanical harvesters to pick them up for cleaning and hulling. The harvest season usually continues into early November.

After hulling and washing, the nuts are transferred from the mechanical harvester into a hopper where they are mechanically dehydrated (air-dried). This protects the nut during transport and storage. Mechanical dehydration is quick, thorough, and scientifically controlled—a major improvement over the sun-drying method formerly used. Walnuts with desirable traits such as big beautiful shells are selected for the in-shell market. Other walnuts are shelled and processed into walnut halves and pieces, and chopped walnuts to be sold in supermarkets across the country.

History – Walnuts are recognized as the oldest known tree food, dating back to 7000 B.C. In fact, walnuts are one of only a handful of trees and plants that can be found growing naturally in both eastern and western hemispheres—strong evidence that the trees existed before the continents split apart. Records indicate Persian nuts (English walnuts) were known during the reign of Tiberius. Remains of this nut have also been unearthed in ancient Rome where walnuts were considered food for the gods and called "Juglans Regia" in honor of Jupiter.

The term "English" applied to the Persian nut is a misnomer. The name "English walnut" refers to the English merchant marines whose ships transported the product for trade around the world. It is thought that the first English walnuts were brought to California by Mission Fathers around 1770. Joseph Sexton planted the first commercial walnut orchard in California in 1867, near Goleta in Santa Barbara County.

Varieties – In recent years, Chandler has been the most popular variety used for shelled walnuts. However, there are more than 30 varieties of commercially produced walnuts, hybrids of the English (Persian) walnut. The varieties were developed to have specific characteristics such as early or late harvest times, thin or thick shells, high percentages of walnut meat, or specific pest tolerances. Five varieties account for more than 80 percent of production: Chandler, Hartley, Tulare, Howard, and Serr.

Commodity Value – In California, 300,000 bearing acres, primarily from Redding to Bakersfield, produce two-thirds of the world's trade in walnuts. California's crop generates more than $1.9 billion in farm gate revenue. Approximately 60 percent of the crop is exported. China, Germany, Japan, Korea, Turkey, and Spain are some of the largest export markets.

Walnut shells can be burned to generate power and heat, or ground and used as pet litter and in sandblasting. In Japan, the shells are used in snow tires to aid traction. Walnut oil is used in gourmet cooking and cosmetics.

Top Producing Counties – San Joaquin County leads production. Other top counties include Butte, Tulare, Stanislaus, and Sutter.

Nutritional Value – In March 2004, the United States Food and Drug Administration affirmed that eating 1.5 ounces per day of walnuts as part of a diet low in saturated fat and cholesterol may reduce the risk of heart disease. A one-ounce handful of walnuts (12-14 halves) contains good polyunsaturated fats (PUFAs) and is an excellent source of the plant-based essential omega-3 fatty acids ALA (2.5 grams). Walnuts contain many antioxidants and are naturally cholesterol and sodium free. They also have four grams of protein and two grams of fiber per serving.

For additional information:
California Walnut Board
(916) 932-7070
Website: www.walnuts.org

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Email: info@learnaboutag.org • Website: LearnAboutAg.org

Walnut Activity Sheet

Year 1
Seedling grafted to Paradox or Black Walnut rootstocks. ➤

Year 2
Orchard leveled, irrigation system installed, trees planted. ➤

Years 2-6
Trees pruned, irrigated and fertilized: weeds and insects controlled by biological chemical and/or mechanical, methods; limited nut production. ➤

Years 7-100
Trees produce full crops averaging 2.01 tons/acre.

Harvest
Orchard floors cleaned to remove vegetative growth.
↓
Shaker shakes nuts from trees; walnuts swept into windrows by a sweeper, picked up by harvester and delivered to a hauler.
↓
Large wire brushes remove remaining husks from walnuts; walnuts dried to moisture content of 8 percent.
↓
Walnuts packaged for market or sent to processors.

Annual Practices

September-October
Early harvest begins.

April-August
Fertilizaion, irrigation and pest management strategies implemented.

November
Late harvest completed; orchard floors cleaned; pruning begins.

December-March
Pruning continues; dormant sprays control mites and other insect pests.

Lesson Ideas

- Make a list of different uses for walnuts and walnut by-products.
- Research how walnut shells are used as an abrasive in industrial applications.
- Classify different nuts based on their size, origin, nutritional value, texture, and color.
- Use walnut shells in math and art activities.
- Discuss the importance of polyunsaturated fats. Walnuts are an excellent source of omega-3 fatty acids, which are necessary because they cannot be produced by the body.
- Bring products made from walnuts or walnut by-products to class.
- California exports walnuts to more than 100 countries around the world. Find some of these countries on a world map. Use the map scale to determine the distance a walnut travels from California.

Fantastic Facts

1. Walnuts are the oldest known tree food.
2. There is no cholesterol in walnuts, and eating walnuts helps reduce the level of cholesterol in the blood.
3. Two-thirds of the world's walnuts are produced in California.
4. A healthy walnut tree can produce crops for approximately 100 years.
5. By-products of walnuts include cosmetics, oil, sand blasting materials, snow tires, and pet litter.
6. After a walnut orchard is planted, it takes four years to produce the first crop.
7. Walnuts used for the in-shell market must have big beautiful shells.

Lesson Plan: Walnut Shell Dye

Introduction: Walnuts are a delicious and healthful snack, and provide valuable by-products for a variety of purposes. Walnut shells can be burned to generate power and heat or ground up to be used as pet litter, sand paper and snow tires. Processed walnut shells can be used for dyeing fabrics and other textiles, as well as staining wood. The color of the dye will change slightly from harvest season to harvest season depending on the health of the walnut tree and nuts.

Objective: Students will use walnut shells to create a dye for art or woodworking projects.

California Standards: NGSS: 5-PS1-1, MS-PS1-2

Materials: Two cups of walnut shells, 1 quart water, stove or heating source, large enamel or stainless steel (not aluminum) pot, sturdy wooden spoon, sieve, container to collect dye, fabric to dye.

Procedure:

1. Review class safety procedures before beginning this experiment.
2. In a large pot, combine two cups walnut shells and one quart water. Soak the shells in the water overnight.
3. The following day, boil the shells in the water for one hour. Be careful not to let the water evaporate completely.
4. Use the sieve to strain the mixture and discard remaining shells. Add the fabric to be colored directly into the dye. Let the material soak in the dye until the desired color intensity is reached. The dye may also be applied to hard surfaces using a paint brush.
5. Discuss the scientific concepts that explain the color change, and have students provide evidence for their reasoning. Does the dye contain walnuts? What would happen if all the water evaporated? Are they observing a chemical or physical change?

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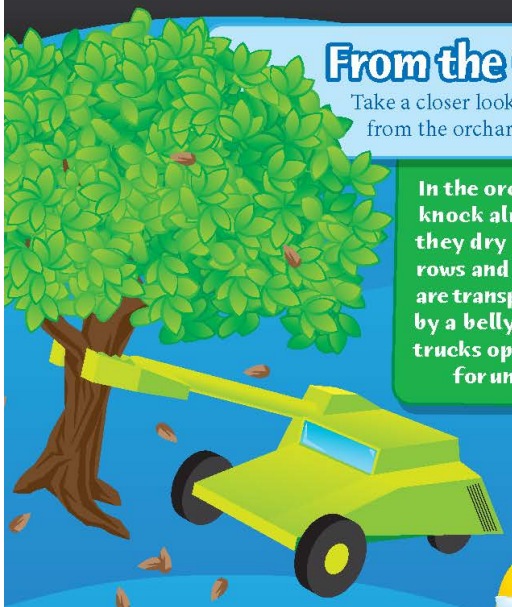
Trade and Transport

From the Orchard to the Open Sea

Take a closer look at a supply chain as we explore how almonds travel from the orchard to the open sea and countries all over the world!



1 In the orchard, mechanical tree shakers knock almonds to the ground, where they dry before they are swept into rows and picked up by machine. They are transported to processing facilities by a belly dump truck. These special trucks open at the bottom of the trailer for unloading.

2 After almonds have been hulled, sorted, graded, and cleaned at the processing facility, they travel to the manufacturing facility and are packed into large bags called supersacks, large boxes called triwalls, or smaller retail packages. The finished product is placed in a dry van and transported to a distribution center.

3 Distribution centers move almonds to customers throughout the world in trucks, rail cars, airplanes, and ships. Almonds heading out to sea are loaded into 20-foot and 40-foot ocean containers, which are specially designed to be loaded on ships. Ships can typically hold between 8,000 and 22,000 containers.

4 A stevedore coordinates the loading of the ship. Once the ship is loaded, it is turned over to a maritime pilot who will navigate the ship to the ocean. Pilots maneuver ships through channels that have been dredged to a depth of 29-35 feet. Once the vessel reaches the ocean the pilot turns the vessel over to the captain, the person in command of the ship.

Activity

Standards: NGSS: 3-5-ETS1-1, 3

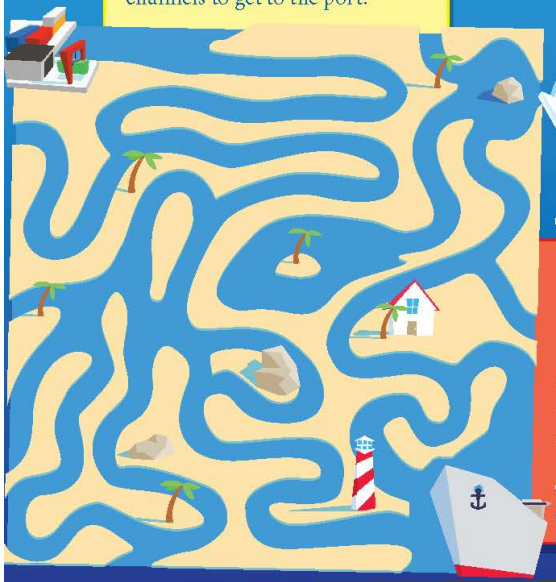
Build a cargo ship out of aluminum foil that can carry agricultural products and see how long it will stay afloat. Compete with others in your class in a controlled environment. After initial testing, make improvements and test again.

Extra! Extra!

For an additional challenge, visit *LearnAboutAg.org/agbites* and check out ***#18: Ag TransPORTation***.

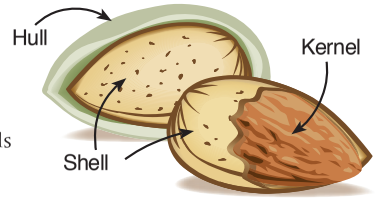
Activity

Pilot this vessel through the channels to get to the port.

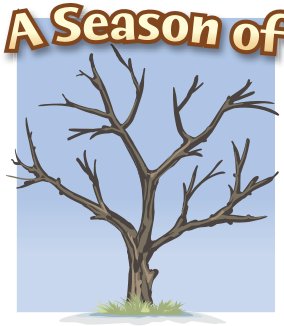


ALMONDS in a Nutshell

Almonds are a Top-Ten crop in California. All the almonds purchased in the United States come from California! And about 80% of almonds purchased in the world come from our great state!



A Season of Almonds

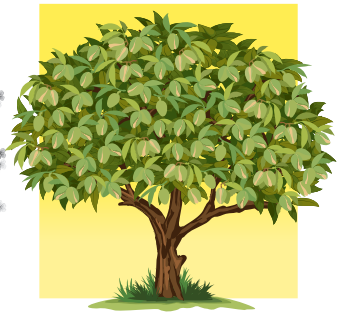


WINTER - Dormancy

- Trees are dormant or resting.
- All leaves have dropped.
- Trees are storing up nutrients.

SPRING – *Pollination*

- For almonds to grow, the trees need to be pollinated. About 1.6 million colonies of honey bees are required to pollinate almond orchards in California.
- In February, flowers bloom on the branches.



SUMMER - Growth

- Almonds continue to mature with the shell hardening and the kernel developing.
- Hulls begin to split, allowing the inner shell to begin to dry.
- When the almonds are ready to be harvested, the hull will begin to open. This is called the hullsplit.

FALL - Harvest

- The **grower** shakes the trees with a machine called a shaker. The almonds fall to the ground.
- After the almonds have dried for about a week, they are swept into rows by a machine called a sweeper.
- Almonds are picked up by a harvester and trucked to a processing plant to be packaged and shipped throughout the world!

Did You Know? That's Nuts!

- **Almonds are used as a protein source for natural disaster victims.**
- **Almond extract is not made from almonds. It usually comes from apricot or peach pits.**
- **Almonds are related to apricots, peaches, and cherries.**
- **Bees can fly 22 miles per hour and fly five miles round trip**
- **Bees have five eyes.**

Activity

Have you tried this?

Take a class survey and find out how many students have tried the following:

Raw Almonds _____

Almond Butter _____

Almond Crackers _____

Marzipan _____

Roasted Almonds _____

Glenda & Shannon Wooten
Apiarist/Beekeeper

CAREER: Apiarist/Beekeeper

Shannon Wooten (pictured with his wife, Glenda), is an Apiarist/Beekeeper and Owner of Wooten Golden Queens, Palo Cedro, CA.

What is your job? I raise and sell queen bees; which is time consuming and technical, so most beekeepers don't do it themselves. I also deliver colonies of bees to almond orchards. A colony is a box of bees with about 40,000 bees and 1 queen.

What is something interesting about your job? I handle my bees without a suit or gloves. If you handle the bees gently, they won't sting you. In the spring time, you can get stung 50-100 times per day!

Anything else you'd like to share? As early as January, I have my bees ready to pollinate trees. I feed them protein and carbohydrates to get them strong and ready for **pollination**.

Source: Almond Board of California, www.almonds.com; University of California Cooperative Extension, fruitsandnuts.ucdavis.edu/datastore

Bee Activity:

Because of a problem called Colony Collapse Disorder or CCD, bees are disappearing across the country. Farmers have to 'rent' bees to pollinate their trees.

Almond farmers depend on bees, but there has been a shortage in the United States. Talk to your local Cooperative Extension or write a letter to your local beekeeper and find out how we can save the bee population. Research online about how to keep bee colonies healthy. Present your findings to your class.

STEM Activity

Design an Orchard

Orchards are planted in different patterns with different spacing. A common pattern is square with spacing of 22 feet x 22 feet. Plan out your own orchard with a scale drawing. Calculate how many trees you will plant per acre and then using graph paper, map out where your trees will be. Use one inch graph paper and show your calculations.

Steps

1. Make calculations:
   1 acre – 43,560 square feet
   Tree spacing – 22 ft x 22 ft = 484 square feet per tree
   43,560 square feet /484 square feet = 90 trees
2. Using 1 inch graph paper, scale your drawing to 1 inch = 22 feet
3. Map out where your trees will be, can you get 90 trees on your page? If not, you will need to show less than 1 acre.
4. Add your math calculations, scale, and any labeling.
5. Decorate your orchard, name your ranch, and color.
6. Challenge: Research other orchard planting patterns and spacing. Do another scale drawing.

CA Standards: ELA CCSS: W.3-5.4, 7, SL.3-5.4, W.6-8.4, 7, SL.6-8.4, RST.6-8.1, WHST.6-8.4, 7; Math CCSS: 3.OA, 3.MD, 4.OA, 4.MD, 5.G.2, 6.NS.2, 3, 6.G.1, 7.NS.2, 3, 7.EE.3, 7.G.1, 7.G.6; NGSS: 3-LS1.B, 4-LS1.A, 5-ESS3-1, MS-LS1.B, MS-LS2.A.

Eastern Europe

Eastern Europeans use nuts in every course of the meal, but nuts really shine in their desserts, cookies, and pastries. Almonds, walnuts, and chestnuts are commonly used for traditional recipes. If Eastern Europe is famous for eating nuts, California is unquestionably famous for growing them.

Q: Why was the almond late for work?

A: Traffic was nuts.

Number One Nut

Standard: CC Math: 3.MD.B.3

Poll your classmates to determine their favorite nut: almonds or walnuts. Create a bar graph illustrating your results.

California Spotlight

California produces the largest supply of almonds in the world. With more than 6,000 growers and 100 almond **processors**, California produces approximately 80 percent of the world's almonds. Walnuts are produced on approximately 350,000 acres, primarily between Redding and Bakersfield. California walnuts account for one-third of the world's supply.

Did You Know?

Walnuts are recognized as the oldest known tree food, dating back to 7000 B.C.

Phenomenal Flowers

Std: NGSS: 4-LS-1

Almonds produce ordinary blossoms, while walnuts produce a long, cylindrical petal-less flower cluster called a catkin. Almonds rely on honeybees for cross pollination between different varieties of almond trees planted in alternate rows. Walnut trees rely mainly on wind pollination, with the wind transferring pollen between male and female flowers.

Which picture above shows an almond blossom? Which picture shows a catkin? What external structures support survival, growth, and reproduction?

Did You Know?

Walnuts and almonds are harvested by a machine that vigorously shakes the tree, causing the nuts to fall to the ground.

Recipe

Roszke

Source: *thespruceeats.com*

From Croatia to Hungry, these crescent cookies are a big part of Eastern European culinary tradition. California grown walnuts will add a subtle nutty flavor, without overpowering the buttery dough.

Dough

2 sticks butter, softened
1 (8 oz) package cream cheese, softened
¼ cup sugar
1 tsp. vanilla

Filling

2 cups flour
½ tsp. baking powder
½ cup milk
½ cup sugar
2 cups walnuts, finely ground
1 Tbsp. butter

Procedure

1. Mix butter, cream cheese, sugar, and vanilla until light and fluffy. Combine flour and baking powder, and add to butter mixture. Divide dough into three equal portions, cover with plastic wrap, and refrigerate two hours.
2. Prepare walnut filling. In a medium saucepan, combine all filling ingredients. Cook over low heat until the butter has melted. Cool before using.
3. On a well-floured surface, roll a ball of dough to 1/8-inch thickness. Cut into 3-inch squares.
4. Place a rounded teaspoon of filling in the middle of each square. Roll dough from the corner. Place seam side down on a lined baking sheet and shape into a crescent. Repeat with remaining dough.
5. Bake for 20 minutes at 350°F or until edges are light brown. Cool, then dust with powdered sugar.

Nuts: They're On A Roll!

Nut rolls are a popular dessert throughout Eastern Europe, particularly at weddings and other holidays. Recipes vary widely from region to region. They are known as *potica* in Slovenian, *strucla orzechami* in Polish, *orechovnik* in Slovak, *povitica* in Croatian, *orehnjaea* in Hungarian, *orehnjaca* in Serbian, *banitsa* in Bulgarian—just to "name" a few.

Use online resources to identify the countries associated with each of the languages featured above. Then, label each country correctly on a map of Eastern Europe.

Standard: CA History-Social Science: HSS Analysis Skill K–5

Folklore for Foodies

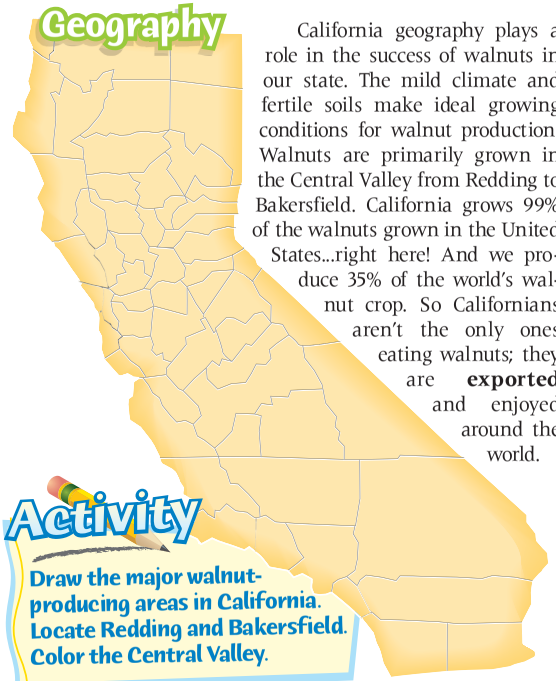
In Bulgaria, nuts are typically offered as part of the Christmas Eve meal. Each family member chooses a nut and breaks it open to predict their luck in the coming year. A white kernel indicates good health and happiness.

Sources: Michigan State University Extension (*canr.msu.edu*)
UC Davis Western Institute for Food Safety and Security (*wifss.ucdavis.edu*)
Agriculture Marketing Resource Center (*agmrc.org*)
Almond Board of California (*almonds.com*)
Walnut Catkin Image: H. Zell (commons.wikimedia.org)

Why Walnuts?

Walnuts are a Top-Ten crop. Why are they in the top ten? Geography, History, and Health…read on to learn more!!!

Geography



California geography plays a role in the success of walnuts in our state. The mild climate and fertile soils make ideal growing conditions for walnut production. Walnuts are primarily grown in the Central Valley from Redding to Bakersfield. California grows 99% of the walnuts grown in the United States...right here! And we produce 35% of the world's walnut crop. So Californians aren't the only ones eating walnuts; they are **exported** and enjoyed around the world.

Activity

Draw the major walnut-producing areas in California. Locate Redding and Bakersfield. Color the Central Valley.

Timeline

7000 BC: Walnuts can be traced back to Persia

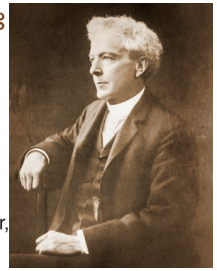
1770 AD: First English walnuts brought to California by Mission Padres.

1867 AD: Joseph Sexton planted the first commercial walnut orchard near Goleta, CA.

1914 AD: Luther Burbank developed the Paradox rootstock variety.

2015 AD: Walnuts are a 1.8 billion dollar crop for California

CAREER: Plant Breeder



Luther Burbank, (1849-1926), Plant Breeder, Santa Rosa, CA

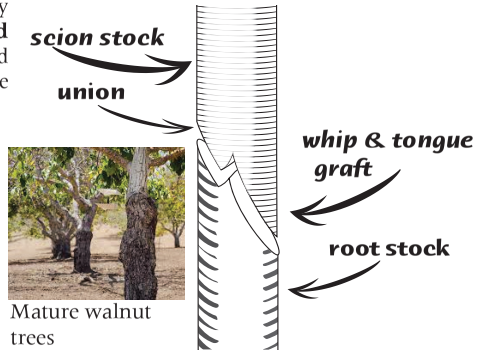
Luther Burbank was a pioneer in plant breeding. During his long 55 year career, he developed over 800 plant varieties including fruit, grains, flowers, and vegetables. One example of his work is the plumcot, a combination of a plum and apricot.

Let's Graft

Did you know you can spot a walnut tree by its base? Most California walnut trees are **grafted**, which means they are actually made of two types of walnut trees! Grafting is the process of putting two plants together so they become one. The point where the two come together is called a union.

Black walnuts are used for **rootstock** because they do not get root disease as easily as other varieties. They are more resistant to root disease.

So why don't we just grow Black walnuts? Black walnuts taste very strong and are smaller. This is why farmers graft a tastier variety such as English walnut onto the Black walnut rootstock. The tree grafted to the top is called the scion stock. A process called "Whip and Tongue" is the most common form of grafting with California walnuts.



Mature walnut trees

STEM Activity: Let's try it!

Materials: 2 different colored straws per student, clear tape, 1 pair of scissors per student

Process:

- Pick one straw. This is your rootstock. Make a sloping diagonal cut, about 1" long.
- On the same straw, make a second cut about 1/3 of the way down from the top of the first cut. This cut should be almost parallel to the first. The straw should now look like it has a tongue!
- Repeat the process on the second straw. This represents your scion stock.
- Line the two pieces up together and tape!

CA Standards: ELA CCSS: SL.3-8.1, 1a, NGSS: 3-LS1.B, 4-LS1-1, 1A, 5-LS2-1, 3-5-ETS1, MS-LS1-2, MS-ETS1.A

Source: http://www.hort.cornell.edu/grafting; California Walnut Board, www.walnuts.org; NASS, http://www.nass.usda.gov/; www.famousscientist.org/luther-burbank

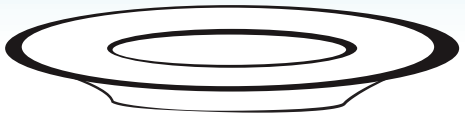
Health

The fact that walnuts are great for you is another reason for their popularity in California. Walnuts are packed with vitamins, minerals, and polyunsaturated fat (the "good" fat!) and contain fiber and protein. Walnuts are also used in foods around the world. In China, walnuts are used in mooncakes, popular during the mid-autumn festival. In Turkey, walnut baklava is a popular dessert, and in Germany, sweet strudel is made with walnuts.

Activity

How would you use walnuts?

Draw a plate with your favorite meal using walnuts.



Many ways for Walnuts!

Walnuts used for snacking or baking are sold whole (in shell or shelled) or chopped. Walnut oil is used for salad dressings and to flavor fish and steaks. Walnut flour can be used for those with **gluten-free** diet requirements. Walnut butter is becoming popular as a substitute for peanut butter.

Activity

With a partner or small group, discuss the meanings of idioms. Then, as a group create your own.

- "Tough nut to crack" (meaning hard to understand or get to know)
- "Everything from soup to nuts" (meaning almost everything one can think of)
- "Go Nuts"
- "Nuts for You"
- "Drive someone nuts"

Pistachios are Nut-tastic

California produces 98 percent of commercial pistachios in the United States.

Did You Know?

It takes six years for a pistachio tree to produce its first fruit and 20 years to reach full production! If well-cared for, pistachio trees can produce nuts for more than a century.

Recipe
Pistachio Butter

2 cups roasted pistachios
½ tsp salt
3 tbsp sugar
Vegetable oil

Place nuts, salt, and sugar in a food processor and blend until you have a rough clump. Add 1 teaspoon of oil at a time and process until it reaches the creamy texture you want.

Practical Pistachio Production

Pistachios are native to Afghanistan, Iran, and Turkey because of the low mountains and barren, dry foothills in the elevated deserts. To produce at maximum capacity, trees need long, hot, dry summers and moderately cold winters.

Activity
Taste Test

Roasted Pistachio Nuts vs. Pistachio Nut Butter

How do roasted pistachios, like you buy in the store, and pistachio butter taste different? Observe and taste a sample of roasted pistachio nuts. Make a list of adjectives to describe the taste. Repeat with a sample of pistachio butter. Compare and contrast the roasted pistachios to the pistachio butter. How can you use pistachio butter?

Standards: ELA – **Grade 3:** Writing 2.2; Written and Oral English Language Conventions (WOLC) 1.2; **Grade 4:** Writing 1.3; WOLC 1.1,1.2; **Grade 5:** WOLC 1.1; **Grade 6:** WOLC 1.1,1.4

Imagine this...

Learn more about pistachios by reading the award-winning story "Peter's Journey" by Brook Jensen. Brook received statewide recognition for her short story about growing and harvesting the practically perfect protein. To learn more, visit www.LearnAboutAg.org/imaginethis/pistachio.

Activity
Nutrition

Convert the tally chart into a double bar graph using one color for fiber and another color for protein.

	Protein	Fiber
Almonds	𝍸 𝍸 𝍸 𝍸 𝍸	𝍸 𝍸
Pistachios	𝍸 𝍸 𝍸 𝍸 I	𝍸 𝍸 III
Walnuts	𝍸 𝍸 𝍸 III	𝍸 III

Standards: Mathematics – **Grade 4:** Statistics, Data and Probability 1.3, Mathematical Reasoning 2.3; **Grade 5:** Statistics, Data and Probability 1.2, Mathematical Reasoning 2.3; **Grade 6:** Statistics, Data and Probability 2.1, 2.2, Mathematical Reasoning 2. 3

In the know about H2O

The California Delta is the largest estuary in North America. It supplies clean water to 25 million people and more than 3 million acres of farmland in California.

1929

William E. Whitehouse entered Persia (Iran) to obtain pistachio seeds.

1929-1930

Whitehouse explored Persia and collected 20 pounds of individually selected pistachio seeds, which he planted in Chico, CA.

1930-1950

3,000 trees grew from 20 pounds of seed. However, only one tree proved to be useful.

1950s

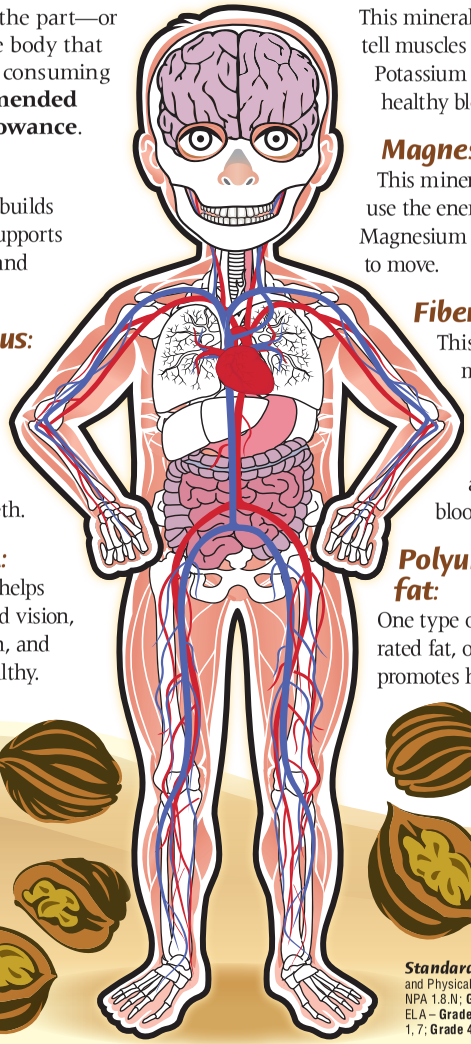
The successful pistachio tree seed was named Kerman for the famous carpet-making city near Rafsanjan in Iran.

Sources: American Pistachio Growers www.thegreennut.org, Administrative Committee for Pistachios www.acpistachios.org

Walnuts
Health in a Nutshell

Activity

Draw an arrow from each **nutrient** to the part—or parts—of the body that benefit from consuming the **Recommended Dietary Allowance**.



Protein:
This nutrient builds muscle and supports brain health and function.

Phosphorus:
This mineral works with calcium and vitamin D to build strong bones and teeth.

Vitamin A:
This vitamin helps maintain good vision, fight infection, and keep skin healthy.

Potassium:
This mineral helps your brain tell muscles when to move. Potassium also helps keep a healthy blood pressure.

Magnesium:
This mineral helps the body use the energy found in food. Magnesium also tells muscles to move.

Fiber:
This nutrient helps move food through the body to prevent constipation. It also helps control blood sugar levels.

Polyunsaturated fat:
One type of polyunsaturated fat, omega-3 fatty acid, promotes heart health.

Standards: **Health – Grade 4:** Nutrition and Physical Activity (NPA) 1.1.N; **Grade 5:** NPA 1.8.N; **Grades 7 and 8:** NPA 1.1.N, 1.2.N; ELA – **Grade 3:** Reading Informational Text (RIT) 1, 7; **Grade 4:** RIT 1; **Grade 5:** RIT 7

Walnuts for Wellness

Not only do walnuts taste great, but research suggests that walnuts may benefit your health. A one-ounce serving contains dozens of nutrients that support a healthy diet. Read the scenarios to determine which nutrients, many of which are found in walnuts, would support the desired health outcome.

Symptom: Feeling weak and wimpy

Rx _____

Symptom: Trouble seeing the board

Rx _____

Symptom: Stomach ache

Rx _____

Symptom: Can't think straight

Rx _____

Standards: Health – Grade 4: Nutrition and Physical Activity (NPA) 1.1.N; Grade 5: NPA 1.8.N; Grades 7 and 8: NPA 1.1.N, 1.2.N

Newspaper Activity

Many walnut farmers use micro-irrigation to deliver water to their crops. Small sprinklers provide just enough water for optimal growth, and can reduce water use by 30 percent. Write a letter to the editor summarizing the water shortage in California and informing your audience how farmers and ranchers conserve this precious resource. Cite specific textual evidence from print and online resources to support your view.

Standards: ELA – **Grades 3-5:** Writing 1, 7; **Grade 6:** Writing 1, 7; **Grades 6-8:** Reading for Literacy in Science and Technical Subjects 1

Did You Know?

99 percent of the nation's walnut supply is grown in California.

Sources:
California Walnut Commission (www.walnuts.org),
Network for a Healthy California's Harvest of the Month (www.harvestofthemonth.cdph.ca.gov)

California Walnuts

The Importance of Grafting

Grades 4-5

Apartnership project of
California Walnut Board
California Foundation for Agriculture in the Classroom

Written by
Robin Satnick
Crane Country Day School
Santa Barbara County

www.LearnAboutAg.org

California Walnuts

The Importance of Grafting

Learning Objectives

The purpose of this unit is for students to understand the science and economic importance of grafting walnut trees.

Grade Level

4th and 5th

Time

Teacher Preparation:
30 minutes

Student activity:
60 minutes

Materials

For each partnership of 3-4 students:

- *two colors of play-doh*
- *plastic knife*
- *6 oz. plastic cup*
- *sand or soil*
- *white paint*
- *paint brush*
- *candle*
- *matches*
- *rubber band*
- *scissors*
- *ruler*
- *toothpicks*

Background Information

California walnut farmers have scientifically learned how to produce nuts with thinner skins, larger nutmeat, and disease and pest resistant trees through a process called **grafting**. Grafting is a common type of plant **propagation** where healthy and disease resistant rootstock is **fused** onto a scion. A scion is a shoot from another plant that contains the desired genes to be duplicated in future production. The scion is often selected due to its leaves, flowers, and in the case of the walnut, its fruit.

Black walnuts are **indigenous** to California, however their thick shell and small nut size are not ideal for human consumption. However, the English walnut that is native to Ancient Persia, now known as Iran, produces walnuts with thinner shells and larger nuts making them a better choice for consumers. English walnuts are more prone to diseases and pests because they are not native to California. This is why California walnut farmers graft black walnut rootstock onto English walnut scions.

There are a number of types of grafting. The most common type is called whip or tongue grafting. Grafting is done in the late spring after the **rootstock** has produced leaves and is less likely to fail. The most difficult step in grafting is making sure that sap doesn't flow from the cut rootstock. To avoid this "bleeding," farmers need to be mindful of weather conditions. In periods of heavy rain or strong temperature **fluctuations**, bleeding is more likely to occur.

Black walnut seeds are planted during October through December. The seedlings emerge in early spring. The seedlings continue growing for one full year until they are strong and large enough to be grafted. Scions, from English walnut trees, are selected for their well-developed buds are collected during the dormant winter months from December to February. They are placed in moist wood shavings or a plastic bag in a refrigerator until the rootstock is ready.

When grafting, it is important to choose a piece of scion wood that closely matches the diameter of the rootstock. The scion and rootstock are both diagonally cut during the whip grafting process. A small slit is cut into the center of the cut pieces. The two cut pieces are matched together and the small slits help lock the rootstock and scion together. The union is sealed with grafting or masking tape. A rubber compound called yellow cap is also used. The young rootstock is painted white to protect it from the sunlight. The top of the unexposed scion is sealed with a grafting wax to keep the top of the walnut tree from drying out.

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California Walnuts

The Importance of Grafting

Common Core Standards

ELA/Literacy

4th Grade
RI.4.1
RI.4.7

W.4.2
W.4.9

NGSS
4-LS1-2

5th Grade
RI.5.7
RI.5.1
RI.5.9
W.5.1
W.5.9

NGSS
5-LS1-1

See last page for complete Common Core Standards descriptions.

Procedure

1. As a class, show informational video on the Walnut.org website on how walnut seedlings are grafted. Provide Background Information to students.

2. Distribute worksheet, "Let's Graft!" to students and read together the informational paragraphs before beginning the activity.

3. Divide students into groups of 2-3 students per group and distribute materials for the activity. Make sure each student will have enough play-doh for 5" long ropes.

4. Explain to students that they will be simulating how grafting is done.

5. Ask students to roll each piece of modeling clay or play-doh separately into ropes that are approximately ½ inch diameter throughout.

6. As students are working, ask them to compare their rolled piece of clay with their lab partner's. Ask them to continue working until they feel the diameter of each rolled piece of clay is the same.

7. Assign each colored piece of clay as the scion or rootstock to help students differentiate between the two pieces that are grafted together.

8. Using the plastic knife, have students cut a diagonal cut that measure approximately 1 ½ inches from one end of one of the ropes and leave the other end untouched. This piece of clay is the rootstock.

9. Ask the students to set the piece of clay down once the appropriate cut has been made.

10. Have students pick up the other piece of clay and make a similar 1 ½ inch diagonal cut on one of the ends. On the other side of the rope, ask students to cut the clay so it is a straight cut. This piece of clay is the scion.

11. Using the plastic knife, ask students to cut a small notch on both

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pieces of clay in the middle of the diagonal cut.

12. Place the ropes of clay end to end with the diagonal cuts and notches connecting together as shown in the diagram.

13. Cut one end of a rubber band. Holding both ends of the rubber band, carefully place the middle of the rubber band in the middle of the graft. Tell students to think of the rubber band like a bandage.

14. Carefully wrap the rubber band around the graft and tie the ends together in a knot.

15. Tell students that farmers paint the rootstock white to protect it from the sun. Ask students to paint their rootstock white.

16. Share with students that farmers dip the top of the scion in wax to keep it from getting dried out. Using the wax from a melted candle, have students coat the top part of the scion with wax.

17. Place sand or soil into a plastic cup. Gently "plant" the grafted walnut seedling making sure to bury only the bottom of the rootstock.

Extension Activities

1. Take the students on a field trip to a walnut orchard nursery. Ask a horticulturist to share with students how walnut seedlings are grafted. Have students make observations of the walnut tree's truck. Can they see where the grafting took place? What do they notice? Compare the size of the young trees with the older trees.

2. Have a walnut farmer visit the classroom and share his work on the farm.

3. As a class, plant a walnut seed and see how long it takes to germinate. Offer students a prompt about the growth of the seed and ask them to write a creative story about what will happen to the seed when it sprouts.

4. Place a stock of freshly cut celery in colored water. Have students observe the changes in color of the celery the next day. Explain to students that plants need water to survive and they draw water up from their roots through their capillaries. The capillaries

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are hollow and act a lot like a straw. Share with students this is why when grafting it is important to match the diameter of the rootstock with the scion.

5. Obtain different species of walnuts (California Black walnut tree, *Juglans californica* and English walnut, *Juglans regia*). Have students compare and contrast the physical difference of each species.

6. Demonstrate the importance of matching diameters of the scion and rootstock when grafting using a celery stalk. Trim the bottom of a celery stalk keeping the leaves intact and place it is a clear cup filled half full of water adding 8 drops of red food coloring until the water is a deep red color. The next day the leaves of the celery will be red. The water and nutrients are carried up through the celery stalk by the xylem. The xylem is the woody tissue in plants that is responsible for the movement of water and nutrients throughout the plant. During the grafting process, it is important to match the woody part of the walnut cuttings so the xylem and phloem (food conducting tissue) have the best possible chance of growing together. This will increase the likelihood of the walnut tree's success.

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Let's Graft!

Name _____

Trees in California walnut orchards are propagated by grafting seedlings in order to produce disease and pest resistant plants with nuts that are optimal for eating. During the grafting process, healthy rootstock from a native black walnut tree is fused with a shoot, or scion, from an English walnut tree. Native trees are more disease and pest resistant than non-native species. The fruit of the English walnut has a thinner shell and more meat than the black walnut making it easier to crack open and more enjoyable to eat.

Materials

• two colors of clay or play-doh	• 6 oz. plastic cup
• white paint	• candle
• rubber band	• ruler
• plastic knife	• sand or soil
• paint brush	• matches
• scissors	• toothpicks

IMPORTANT – When you are not working with the clay set it down in your work area. Holding the clay will cause warming and could affect the results of this activity.

Procedure

1. Roll each piece of modeling clay or play-doh separately into ropes that are approximately ½ inch in diameter and 5" in length.
2. Using the ruler, compare each rope and continue working with the clay until the diameters of both pieces are the same.
3. Using a toothpick and a ruler, mark cutting lines described in steps 3 and 4 below.
4. Using a plastic knife, cut one end of <u>one of the ropes</u> with a 1-½ inch diagonal cut. Do not cut the other end of this rope. This piece of clay is your rootstock.
5. Take the other piece of clay and cut a 1-½ inch diagonal on one end. On the other end, cut the clay straight across. This is your scion.
6. Using the plastic knife, cut a small notch on both pieces of clay in the middle of the diagonal cut.
7. Place the ropes of clay end to end with the diagonal cuts and notches connecting together as shown in the diagram.
8. Cut one end of a rubber band. Holding both ends of the rubber band, carefully place the middle of the rubber band in the middle of the graft. The rubber band is like a bandage covering the plant's wound.
9. Carefully wrap the rubber band around the graft and tie the ends together in a knot.
10. Using white paint, coat the rootstock white to protect it from the sun.
11. With your teacher's help, dip the top of the exposed scion with melted candle wax to protect the plant drying out.
12. Place sand or soil into a plastic cup. Gently "plant" the grafted walnut seedling making sure to bury only the bottom of the rootstock.

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Let's Graft (continued)

Conclusion

1. Why do walnut farmers graft their trees?

2. Why do you think native plants are better at fighting diseases and pests that non-native plants?

3. What time of year is best for planting the seeds of walnuts?
    a. summer
    b. fall
    c. winter
    d. spring

4. How long does a walnut seedling grow before it is ready to be grafted?
    a. 3 months
    b. 6 months
    c. 9 months
    d. 12 months

5. Why do farmers paint the rootstock of walnut trees white when they are young?
    a. the nutrients help them grow
    b. to keep the rootstock warm in the winter
    c. to keep the rootstock from getting sunburned
    d. to mark the plants that have been grafted

6. A scion is:
    a. a small piece of rootstock
    b. the hard exterior of a nut
    c. the shoot of a plant with the desired genes for growth
    d. a young tree

7. There are many different kinds of propagation methods that walnut farmers utilize in order to produce more walnut trees for their farms. Research this website and compare two different kinds of walnut propagation: *http://fruitandnuteducation.ucdavis.edu/education/fruitnutproduction/Walnut/Walnut_Propagation/* In the space provided below, write a paragraph stating which kind of propagation method you would choose and why.

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Answer Key

Let's Graft

1. *Why do walnut farmers graft their trees?* **Native black walnut trees are hearty and more disease and pest resistant then walnut trees that are introduced to California. The English walnut from Ancient Persia has larger fruit and a thinner shell making it easier for consumers to enjoy. Therefore, by grafting these two species of trees, farmers are able to get hearty trees and better fruit.**

2. *Why do you think native plants are better at fighting diseases and pests that non-native plants?* **Native plants evolved with the other native plants and wildlife, therefore they are best suited to meet the needs within their ecosystem. Overall, native plants are better adapted to the environmental conditions where they originated.**

3. *What time of year is best for planting the seeds of walnuts?* **winter**
   a. summer
   b. fall
   c. winter
   d. spring

4. *How long does a walnut seedling grow before it is ready to be grafted?* **12 months**
   a. 3 months
   b. 6 months
   c. 9 months
   d. 12 months

5. *Why do farmers paint the rootstock of walnut trees white when they are young?* **To keep the rootstock from getting sunburned**
   a. the nutrients help them grow
   b. to keep the rootstock warm in the winter
   c. to keep the rootstock from getting sunburned
   d. to mark the plants that have been grafted

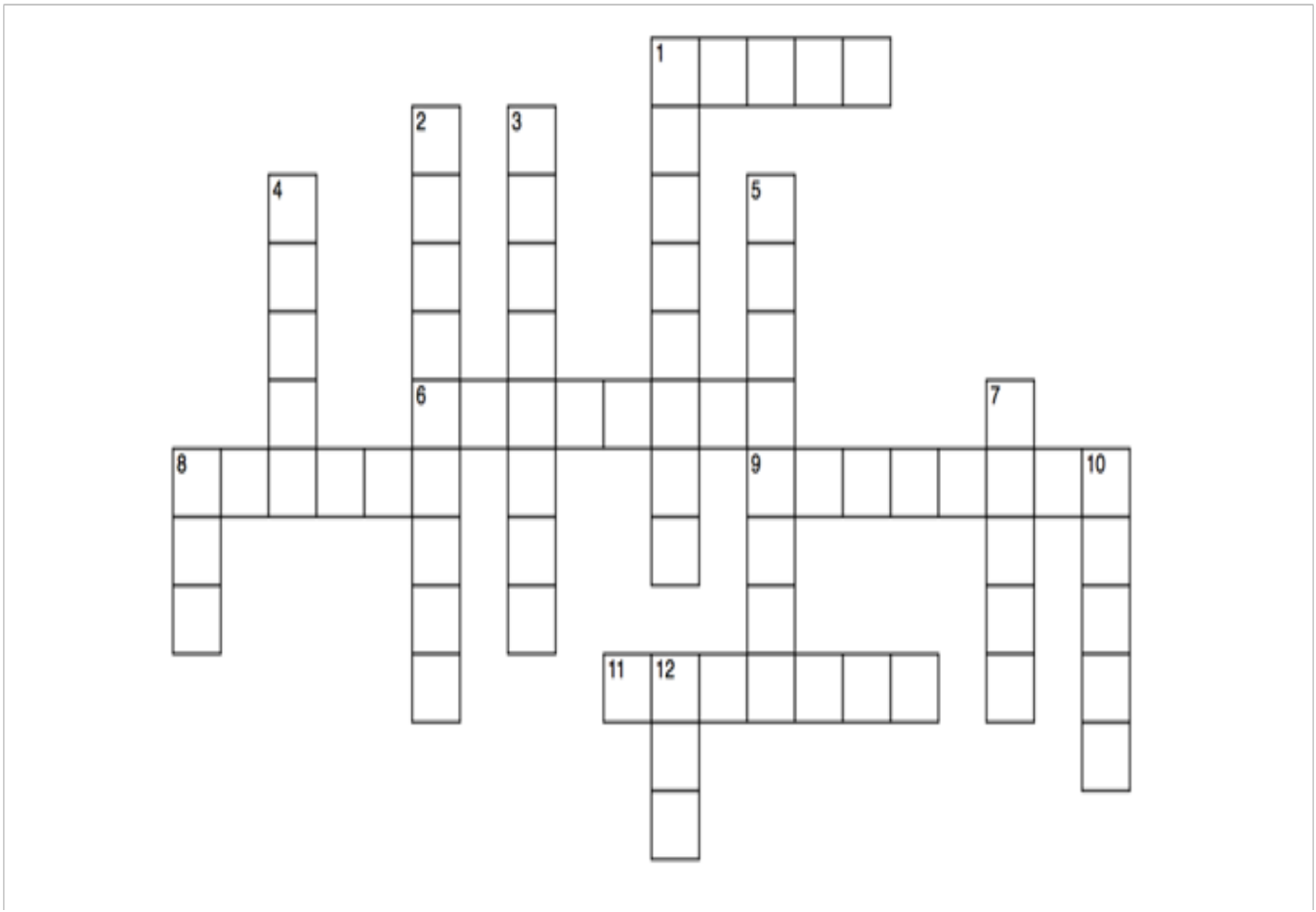
6. *A scion is:* **the shoot of a plant with the desired genes for growth**
   a. a small piece of rootstock
   b. the hard exterior of a nut
   c. the shoot of a plant with the desired genes for growth
   d. a young tree

7. There are many different kinds of propagation methods that walnut farmers utilize in order to produce more walnut trees for their farms. Research this website and compare two kinds of propagation—June budding and grafting: *http://fruitandnuteducation.ucdavis.edu/education/fruitnutproduction/Walnut/Walnut_Propagation/* In the space provided below, write a paragraph stating which kind of propagation method you would choose and why.

Walnut Grafting

Crossword Puzzle

Name _____



ACROSS

1 A species of walnut that is native to California
6 A young developing plant.
8 A delicious nut that many people enjoy.
9 An intentional planting of trees for food or consumption
11 The species of walnut that was first found in Ancient Persia

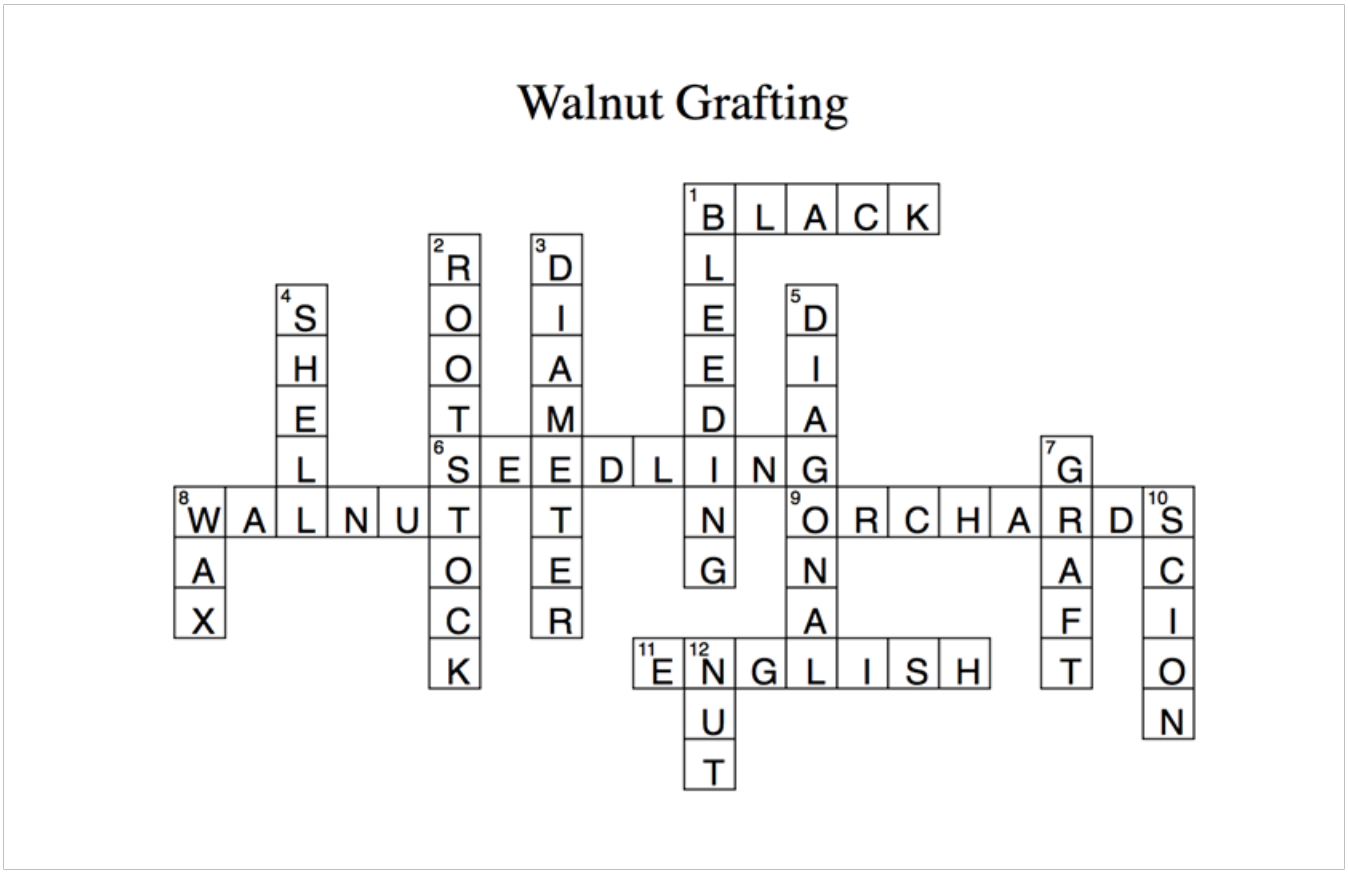
DOWN

1 The release of sap from a plant
2 The underground part of a plant.
3 A straight line segment that passes through the center of a circle
4 The hard exterior of a nut.
5 A sloping line
7 The process of fusing a rootstock with a scion.
8 A chemical used to coat the seedling so it doesn't dry out
10 The shoot of a plant with the desired genes for growth
12 A fruit composed of a hard shell and seed

Lessons developed in partnership with California Foundation for Agriculture in the Classroom *www.LearnAboutAg.org*

Answer Key

Crossword Puzzle



Vocabulary

The Importance of Grafting

Fluctuate – to shift back and forth unpredictably

Fuse – to become blended or joined

Graft – to insert a twig or bud from one plant into another plant so that they are joined and grow together

Indigenous – native, or original

Propagate – to grow, generate, or produce

Rootstock – a root or part of a root to which an aboveground plant part is grafted

Common Core Standards

ELA/Literacy

4th Grade

RI.4.1 Refer to details and examples in a text when explaining what the text says explicitly and when drawing inferences to the text.

RI.4.7 Interpret information presented visually, orally, or quantitatively (e.g., in charts, graphs, diagrams, time lines, animations, or interactive elements on web pages)

W.4.2 Write informative explanatory texts to examine a topic in order to write or speak about the subjects knowledgeably.

W.4.9 Draw evidence from literacy or informational texts to support analysis, reflection or research.

NGSS
4-LS1-2 Use a model to test interactions concerning the functioning of a natural system.

5th Grade

RI.5.7 Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently

RI.5.1 Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from a text.

RI.5.9 Integrate information from several texts on the same topic in order to write or speak about the subject knowledgably.

W.5.1 Write opinion pieces on topics or texts, supporting a point of view.

W.5.9 Draw evidence from literacy or informational text to support analysis, reflection or research.

NGSS
5-LS1-1

*Support an argument with evidence, data, or a model.

*Plants acquire their material for growth from air and water.

Pick-A-Peck

February - Leafy Greens

Five **Fun Facts** About Spinach & Lettuce!

- Americans consume an average of 30 pounds of lettuce per person each year.
- There are three types of spinach varieties: Smooth Leaf, Savoy and Red Veined.
- Lettuce was recently grown, harvested and eaten aboard the International Space Station.
- Spinach typically takes 21-50 days to grow. Lettuce can take from 65 to 130 days to grow, depending on what time of year it is planted.
- There are three types of lettuce varieties: head, leaf and romaine.

Three **Fun Teaching Ideas!**

- Read the book, *Tops and Bottoms* by Janet Stevens, and use the ideas in the Ag-Bite activity to bring the book to life!
- Use the Fact and Activity Sheets and other research, to compare and contrast the nutritional value of lettuce and spinach.
- Have students create a salad recipe! Check out the word problems on the *Lettuce Introduce You* page from *What's Growin' On?*.

Explore all the great spinach and lettuce resources in this section!

Learn About Ag®
California Foundation for Agriculture in the Classroom

Commodity Fact Sheet

Lettuce

Information compiled by California Foundation for Agriculture in the Classroom

How Produced – Cool weather is important in lettuce production. Lettuce is a cool-season, annual crop. It grows best in moderate daytime temperatures (73° F) and cool nighttime temperatures (45° F). Lettuce grows well in loose, fertile, sandy-loam soils that are well-supplied with organic matter. Soil should be well-drained and moist, and have a slightly acidic pH of 6.0 to 6.5. Since lettuce seeds are so small, a well-tilled seedbed is essential - large clods will reduce germination. Lettuce is hand-harvested and takes place year-round, from April to October in the Salinas Valley, California and from November to March in Yuma, Arizona. Lettuce is one of the top three vegetables produced in the US, along with tomatoes and potatoes. Iceberg lettuce accounts for about 1/2 of the lettuce produced in the US, with the other 1/2 including romaine, butterhead and leaf lettuces. Growing, harvesting, and marketing of lettuce is mainly from large-scale growers with organic production gaining in popularity. World-wide, the US is the second largest lettuce producer (behind China), with most of the lettuce coming from California and Arizona.

History – Lettuce is one of the oldest known vegetables. There are Ancient Egyptian tomb drawings depicting lettuce dating back to about 2500 BC. The Egyptians believed it aided in sleep. Originally used for its seeds to produce oil, it then began to be grown for its leaves. Lettuce spread to the Greeks and Romans who gave it its name lactuca. In Rome, Emperor Caesar Augustus built a statue praising lettuce because he believed eating lettuce had cured him of an illness. It was introduced to North America by Christopher Columbus during his second voyage in 1494. Many varieties developed during the 16th through 18th centuries in Europe. Different forms became popular in different regions. Stem lettuce was most popular in the Mediterranean, Egypt, the Middle East, and China. In Northern Europe, butterhead was most popular. Lettuce varieties have changed over the years. The long, thick-stemmed variety of the past, has evolved into leafier, greener types. In recent times, salad bars have become popular (1970s), and salad mixes of pre-washed and packaged greens have become available (1990s).

Varieties – There are several types of lettuce, but the three most common are head, leaf, and romaine. Iceberg lettuce has been the most popular variety, indicated by the largest area harvested, most tonnage produced, and most revenue generated. A shift from iceberg to leaf lettuce being the most popular has occurred in the last ten years. Varieties differ in color, texture, and amount of nutrients.

Commodity Value – In 2014, lettuce was number six in California commodity values, generating sales of 2 billion dollars. Lettuce is in the top 20 of California exports, coming in at number 14 with $337 million in sales. Canada takes in the highest amount of California grown lettuce exports at 88%. Imports of lettuce to California are limited to less than 5%, and come from Mexico and Canada.

Top Producing Counties – Monterey County is the top lettuce producing county, producing more than 70 percent of the crop and generating 1.48 billion dollars. The second highest producing county is Imperial at $158 million, and third highest is Santa Barbara at $107 million. Lettuce is easy to grow and yet sensitive to temperature – frost damages it, and heat causes the stem to grow quickly and the plant to go to seed. Ideal conditions are mild weather, and moist, fertile soil explaining why the coastal counties do well in spring and summer months and Imperial County and Arizona do well in winter months.

Nutritional Value – Lettuce is low in calories, fat-free, cholesterol-free, and low in sodium. It has 11 calories per one cup. Lettuce contains dietary fiber along with omega fatty acids that promote good health. Lettuce also provides immune capability with the help of mineral contents like manganese, magnesium, potassium, iron, phosphorus, and calcium. Presence of these mineral compounds decreases harmful free radicals in the body and improves the body's immune system as well as protects from viral infections and related diseases. The iron content in lettuce contributes many beneficial properties for health. Iron is required for the formation of red blood cells and the transportation of oxygen to different parts of the body. These nutritional benefits of lettuce can help prevent anemia and aid in protecting the body from indigestive agents. Lettuce also breaks down heavy protein and carbohydrates helping the stomach function properly. Lettuce contains vitamin A (which helps protect the eye), vitamin C, thiamine and vitamin B6.

For additional information:

California Leafy Green Products
(916) 441-1240
Website: www.safeleafygreens.org
YouTube: youtube.com/user/CALeafyGreens

Leafy Greens Council
(716) 517-0248
Website:www.leafy-greens.org

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This is one in a series of fact sheets composed by the California Foundation for Agriculture in the Classroom (CFAITC). For additional educational materials: CFAITC, 2600 River Plaza Drive, Suite 220, Sacramento, CA 95833-3293 • (916) 561-5625 • (800) 700-AITC • Fax: (916) 561-5697
Email: info@learnaboutag.org • Website: LearnAboutAg.org

Lettuce Activity Sheet

ANCIENT EGYPT

- Tomb paintings depict lettuce
- Stems used instead of leaves
- Grown for seed and oil

2500 B.C.

CHINA

- Consumed as a cooked vegetable
- Lettuce traveled to Persia, Greece, Rome
- Stem lettuce variety native to the area

5TH CENTURY

WESTERN EUROPE

- Shorter-stemmed varieties developed
- Christopher Columbus brought lettuce to the New World

15TH CENTURY

AMERICA
Modern Varieties Developed


Butterhead


Romaine


Crisphead


Loose Leaf

EARLY 1900s

WORLD

- Salad bar popularity
- Plant breeding for disease-resistance and more varieties

1970s

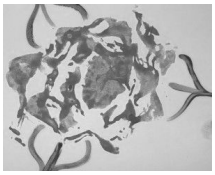
CALIFORNIA

- 1/3 of California-grown lettuce is sold in ready-to-eat packaging
- Contributes 70% of total lettuce exports

TODAY

Lesson Ideas

- Research Ready-to-Eat bagged lettuce. Include when it started and its success. Compare its popularity to head lettuce.
- Make an artistic salad using leafy greens and other vegetables.
- Identify and illustrate different lettuce varieties.
- Research Lettuce Mosaic Virus and/or the Soil-Dwelling Springtail.
- Create a green smoothie recipe.
- Using the art principle of perspective, research and draw a lettuce or other agricultural field.
- Create artwork using lettuce head stamping (art, see below).



Fantastic Facts

1. Lettuce is a member of the sunflower family.
2. Over 90% of lettuce sold in the US is grown in California and Arizona.
3. California is the “salad bowl’ of America, producing a year-round supply of lettuce, celery, broccoli, and cauliflower.
4. Americans consume 30 pounds of lettuce per person each year.
5. The first modern iceberg variety was created by TW Whitaker of the USDA and was named Great Lakes, although it was developed in California.
6. Lactuca sativa is the botanical name for common garden lettuce.
7. Drawings of lettuce are found on ancient Egyptian tombs.
8. Lettuce was recently grown, harvested, and eaten on board the International Space Station.

Lesson Plan: Growing Lettuce From a Stem

Introduction: Lettuce and other leafy greens can be grown from a cutting. Have your students design a science experiment to observe the phenomenon. Research and find out why it works.

Objective: Students will investigate what plants needs to grow.

California Standards: CC ELA: SL.3-12.4, WHST.6-12.7
NGSS:4-LS1-1, 5-LS1-1, MS-LS1, HS-LS1

Materials: Stems or cuttings from heads of lettuce, bowls, water, observation tools – notebook, pencil, thermometer, ruler.

Procedure:

1. Brainstorm what plants need to grow. Ask what would happen if we cut the stem of the lettuce off and put it in water? Have students make predictions. Students will work in groups of 3-4.
2. Bring in heads of lettuce for each group. Cut the stem off about 1 inch from the bottom. Save for the experiment. Use the lettuce for a class salad.
3. Place the cut stem in a bowl of water. Add about ½ to 1 inch of water.
4. Place the bowl in the window or under lights.
5. Draw a picture and record other measurements such as date, time, temp, size, lettuce type, etc.
6. Change the water in the bowl every other day and observe the cutting every day. Watch for new leaves and roots. Make observation notes.
7. After two weeks, you may plant your lettuce in a pot or outside. Continue to make observations.
8. Research why the plants were able to grow after being cut and only with sun and water. Consider other experiments you can conduct to improve lettuce growth.
9. Have groups present their results using evidence, data, and a model to support their findings.

02/19 Learn About Ag

This Fact and Activity Sheet was developed by California Foundation for Agriculture in the Classroom in conjunction with California educators and meets the required education standards of the California Department of Education.

Commodity Fact Sheet

Spinach

Information compiled by Fresh Express

How Produced – Before planting, the farmer will till and prepare the soil. Spinach can be grown on a variety of soil types but the best crops come from sandy loam soil, which is usually found along rivers. The sandy ground makes harvesting easier after rainfall because of good drainage. Drainage quality also affects the irrigation cycle. Since spinach is not a deep-rooted crop, it relies on frequent irrigations to maintain the proper soil moisture levels for ideal growth.

Approximately 90 percent of U.S. spinach is grown in California and Arizona. Spinach grows best during cool periods of the year. Almost 50 percent of spinach produced in California is grown in the Salinas Valley in Monterey County, where spinach is produced from February through November. Spinach is a quick-growing, cool-season vegetable that grows best at temperatures from 45ºF to 75ºF. The foggy and cool summers of the California central coast and the clear and cool winters of the Arizona desert provide ideal growing conditions for spinach.

Spinach is planted relatively shallow at about ½ to ¾ inch depth and at high seed densities of 21 to 48 seed lines per 80-inch beds. These high seed densities result in about 3.5 million plants per acre. Spinach can be harvested in the Salinas Valley 21 to 50 days after planting. Spinach is grown for fresh market (bunched or packaged) and for the processing (frozen) industry. Most of the spinach is mechanically harvested using a machine with a front cutter bar. After harvesting, spinach is typically cooled to 34ºF at centralized cooling facilities before being transported to the processing plant. Spinach has a very high respiration rate and is therefore quite perishable. If kept at low temperatures, spinach can be stored for 14 to 18 days.

History – Spinach has been consumed for thousands of years. It is believed that spinach made its way into Indian and Asian cooking through Arab traders who carried it to Asia from the Middle East. In the 11th and 12th centuries, spinach became a popular vegetable in Spain, and from there it diffused to Germany, Italy, England, and France. It has been used in salads, soups, in baked dishes with cheese, yogurt, and in tortellini. In the early 19th century, American colonists introduced spinach to North America. At least three varieties were grown by 1806. With the development of canning and freezing, the popularity of spinach increased world-wide. The increase in spinach consumption in the U.S. has been due to the sale of freshly packaged teen and baby spinach.

Varieties – Types of spinach are classified as smooth leaf, savoy, and red veined. California grows all three. Smooth leaf varieties have a mature leaf length of about six inches. Savoy spinach is very crinkly and has the same sized leaf as the smooth leaf variety. Red veined spinach has a smaller leaf, similar to the all-green baby leaf types, but adding attractive color and nutrients associated with the red color in the leaf veins. There are many varieties in each type of spinach. Popular varieties in California include Avenger, Bolero, Bossanova, Dolphin, Emilia, Falcon, Lazio, Palco, Unipak, and Whale. Varieties are constantly being developed and may replace these currently popular ones.

Commodity Value – The acreage of fresh market spinach in California has continuously increased by 30 percent over the last decade from 15,000 acres in 2001 to 19,600 acres in 2011, while the acreage of processing spinach remained constant at 7,300 acres. In 2011, the total crop volume for spinach (fresh market and processed) was 606 million pounds, showing an increase of 59 percent from 2001. California accounts for 58 percent of the nation's total spinach production. Spinach ranks number 41 among all commodities grown in California.

Top Producing Counties – The top counties for spinach production in California are Monterey (66 percent), San Benito (9 percent), Imperial (8 percent), Ventura (6 percent), and Santa Barbara (4 percent).

Nutritional Value – Fresh spinach is a good source of anti-oxidant vitamins like A and C and phenolic antioxidants like lutein, zeaxanthin, and beta-carotene. These compounds are scavengers against free radicals and play a healing role in aging and different diseases, including cancer, and promote normal eye-sight. Spinach is an excellent source of vitamin K, which is important for strengthening the bone mass. It also contains vitamin B6 and folates.

For additional information:
Chiquita Brands/Fresh Express
(831) 772-6057
Website: www.freshexpress.com

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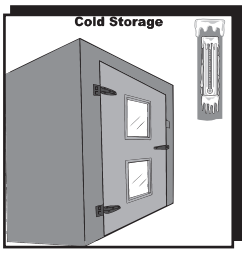
Email: info@learnaboutag.org • Website: LearnAboutAg.org

Spinach Activity Sheet

➤ #1

Food safety specialists carefully examine field conditions, monitoring crop quality and food safety compliance prior to planting, and during production and harvest.



➤ #2

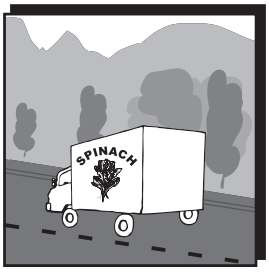
Cold temperatures are critical to freshness. Growers cool down spinach within hours of harvesting and keep it chilled from the field to the store.

➤ #3

From the field, spinach is transported to packaging facilities where it is thoroughly washed, rinsed, and gently dried. Often spinach is packaged in a breathable bag for long-lasting freshness.

#4 ➤

After packaging, spinach is transported swiftly and safely to retail locations across the country. Maintaining consistent cold temperatures is important so every refrigerated truck is monitored throughout its journey to ensure spinach stays cool, fresh, and delicious.



#5 ➤

Consumers enjoy eating spinach. Everyone knows that fresh spinach makes a delicious side dish, but it also makes a nutritious meal on its own.

Lesson Ideas

- Traceability systems inform consumers about where their food comes from and plays a significant role in minimizing food safety risks. Visit *www.freshexpress.com/yoursaladstory* to track the origins of fresh, packaged spinach.
- Locate on a Western U.S. map where spinach is predominantly grown. What are the climatic differences or similarities?
- Based on the total pounds of spinach produced in California in 2011, how many pounds would have been grown in Monterey County? How many tons is this?
- Illustrate the process of photosynthesis and explain the role chlorophyll plays in spinach growth.
- Compare and contrast the nutritional value of spinach to other leafy greens such as mizuna, iceberg lettuce, and arugula.
- Create a delicious recipe using spinach and provide a cooking demonstration for the class. Explain safe food preparation and give everyone in the audience a sample.

Fantastic Facts

1. The three main spinach varieties are Smooth Leaf, Savoy, and Red Veined.
2. It takes 21 to 50 days for a spinach plant to mature.
3. After harvest, spinach is cooled to a temperature of 34 degrees F.
4. Spinach is a significant source of vitamin A, vitamin C, vitamin B6, vitamin K, folate, beta-carotene, lutein, and zeaxanthin.
5. The best spinach crops come from sandy loam soil, which has good drainage and makes harvesting easier.
6. The Salinas Valley produces the most spinach in California.
7. California grows 58 percent of the nation's total spinach.
8. Spinach originated as a food crop in the Middle East.

Lesson Plan: Steamed or Raw?

Introduction: Spinach is packed with nutrients, easy to prepare and tasty too! In fact, spinach can be prepared many different ways. This activity will encourage students to add spinach to their diets.

Objective: Students will compare the visual appearance, taste, texture, and smell of fresh and steamed spinach.

California Standards: CC ELA: W.3-12.7; WHST.6-12.2, 7 NGSS: 5-PS1-2; MS-PS1-2

Materials: Raw and steamed spinach (prepared before or during class), paper plates, forks, napkins, observation journals, pencils.

Procedures:

1. After students wash their hands, instruct them to use all their senses to observe the raw spinach. Keep in mind color, texture, smell, sound, and taste. Students may record observations in their journals.
2. Repeat the observation activity above with steamed spinach.
3. Research and compare the nutritional value of raw and steamed spinach. Discuss why the nutritional values differ and investigate the chemical processes involved in cooking spinach.
4. Determine the differences in serving size for raw and steamed spinach.

   one cup raw = __ cup steamed

5. Ask students to explain which type of spinach they liked best and why. Discuss the balance between choosing the most nutritious product and personal taste preference.
6. Optional: Give students the opportunity to compare the qualities and nutritional value of canned and frozen spinach too.

02/19 Learn About Ag This Fact and Activity Sheet was developed by California Foundation for Agriculture in the Classroom in conjunction with California educators and meets the required education standards of the California Department of Education.

'Lettuce' Introduce You...

Lettuce, a leafy vegetable we use for salad, in sandwiches, and other dishes, is known to scientists by its scientific name of Lactuca sativa.

Lettuce has a long history in California. Lettuce began to be **cultivated** commercially in California in the 1930s. Today, lettuce is in California's Top-Ten most valuable agricultural commodities. California is the leading producer of lettuce in the United States, producing more than 73% of all lettuce grown in the United States. It grows year round in California. Monterey and Imperial counties are the top producers of lettuce.

There are three main kinds of lettuce: head, leaf, and romaine. Head lettuce is round and tight and shaped like a cabbage. Iceberg lettuce is a type of head lettuce. Leaf type is loose and leafy. Butter, Red and Green Leaf are types of leaf lettuce. Romaine is tall with slender leaves.

Activity

Identify each kind of lettuce; write your answer under each one.

Lettuce: How do you grow?

The lettuce you purchased at your local market is very fresh. There is a lot of planning and preparation before a lettuce crop is planted. First, the farmer prepares the field by using a laser to level the field, then **beds** are prepared to plant seeds. Sprinklers or drip irrigation are used to water the emerging plants and throughout their growing season. It is important to fertilize plants so that plants are healthy. **Integrated Pest Management (IPM)** is used to control pests and diseases that could harm plants. Lettuce is harvested carefully and quickly when it is ready to eat. Harvested lettuce is cooled and stored just above freezing to keep it fresh. Lettuce is then transported in a refrigerated truck to market.

'Lettuce' Keep you Healthy!

Lettuce may help maintain
- Vision
- Healthy immune system
- Cell growth

95% of lettuce is water!

Lettuce is high in Vitamin A

Activity

Circle key words in the paragraph above. Then draw a pictorial timeline of the eight steps of lettuce production. Write a caption for each picture using evidence from the paragraph above.

Today there are many options in purchasing lettuce. Lettuce can be purchased unwrapped or wrapped in cellophane, in bulk, or even in a bag as a prepared salad mix.

Activity

Create a salad recipe for two using California Lettuce. Use other "Top-Ten" California commodities as ingredients (walnuts, almonds, strawberries, tomatoes, grapes). Create and write your recipe. Be sure to record ingredients, measurements (in standard form like cups, teaspoons, etc) and instructions. Then, figure out the recipe for the entire class!

Salad for Two

Salad for the Class

Career Spotlight

What jobs are involved in producing lettuce? Choose a job related to lettuce production using evidence from the text or doing additional research. On a separate sheet of paper, draw a picture of yourself in a lettuce career spotlight, and write a paragraph about what you do.

STEM: How long do you grow?

Using a calendar, compute the answer:

When is Harvest? When lettuce is planted in the summer, it takes 65 to 80 days to grow. If it was planted on June 5, what would be the earliest day it could be harvested?

When to Plant? If lettuce is planted in late fall, it could take as long as 130 days to grow. If you want to harvest on January 12, when should you plant?

CA Standards: ELA CCSS: RI.3-4.1, 7, W.3-5.2, 7, SL.3-5.2, RI.6-8.1, W.6-8.2, 7, SL.6-7.2, RST.6-8.1, 7, WHST.6-8.7; Math CCSS: 3-4.MD.2, 5.MD.1, 6.NS.1, 7.NS.2; NGSS: 3-LS1-1, 4-LS1.A, 5-LS1-1, LS1.C, MS-LS1-1

Source: http://learnaboutag.org/caspecialtycrops/agbites.pdf, http://anrcatalog.ucdavis.edu, www.cdfa.ca.gov

8 Tops or Bottoms

Grades K-3

Encourage students to eat more fruits and vegetables by familiarizing them with the plant parts we eat.

Activity

1. Read the book "Tops and Bottoms" by Janet Stevens.

2. Have all of the fruits and vegetables from the book in a basket. Discuss the fruits and the vegetables with the students.

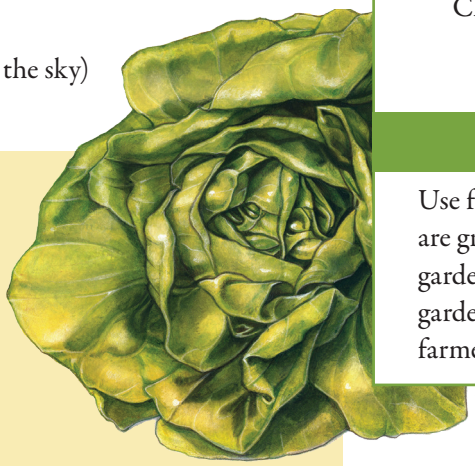
3. As you pull random fruits and vegetables from the basket or grocery bag have students make the following gestures based on how the fruit or vegetable grows:
   - grows underground (touch their toes)
   - grows in the middle (crouch)
   - grow on top of the soil (stand tall with hands to the sky)

Materials

- Tops and Bottoms by Janet Stevens
- Grocery bag or basket
- Assortment of fruits and vegetables
- Photos of fruits and vegetables: Fresh Fruit and Vegetable Photo Cards, CDE.ca.gov (optional)

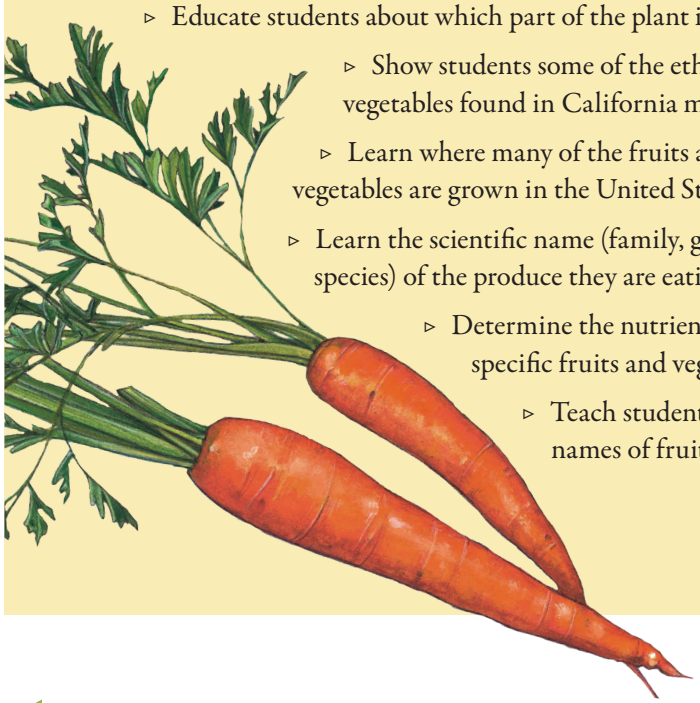
Tip

Use fruits and vegetables that are growing in the school garden, from students' home gardens, or from a local farmers market.



Classroom Activities

- Divide a piece of paper into TOP, MIDDLE, and BOTTOM. Brainstorm fruits and vegetables for each category.
- Define these plant parts: stem, roots, fruits, flowers.
- Use California Department of Education's Fresh Fruit and Vegetable Photo Cards to enhance the activity:
  - ▹ Distribute one card per student and instruct them to sort themselves based on plant part we eat, color, calories (highest to lowest), major producing states, or alphabetically.
  - ▹ Introduce students to some of the less well-known fruits and vegetables.
  - ▹ Educate students about which part of the plant is commonly eaten.
  - ▹ Show students some of the ethnic fruits and vegetables found in California markets.
  - ▹ Learn where many of the fruits and vegetables are grown in the United States.
  - ▹ Learn the scientific name (family, genus, species) of the produce they are eating.
  - ▹ Determine the nutrient analysis of specific fruits and vegetables.
  - ▹ Teach students the Spanish names of fruits and vegetables.



California Standards

Kindergarten
ELA CC: SL.K.1, 2; RI.K.1, 4, 10
Physical Education Content: 1.1, 1.4, 1.8, 3.1 5.2, 5.4

Grade 1
ELA CC: RI.1.1, 4, 10; SL.1.1, 2
Physical Education Content: 2.2, 3.1, 5.1, 5.2, 5.6

Grade 2
ELA CC: RI.2.1, 4, 10; SL.2.1, 2
Physical Education Content: 1.2, 5.1, 5.2

Grade 3
ELA CC: RI.3.1, 4, 10; SL.3.1, 2

This is one in a series of Ag-Bites developed by CFAITC. Ag-Bites meet the standards of the California Department of Education.
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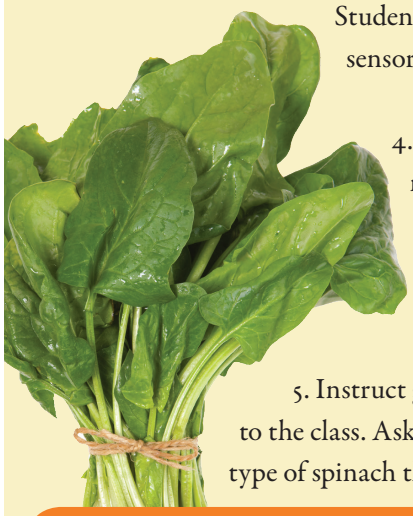
Frozen, Canned or Fresh?

Cook three different kinds of spinach. The fresh spinach should be well washed, drained and cooked. Give each student group an equal share of frozen, canned and fresh spinach.

1. Show students a package of frozen spinach, a can of spinach and a bunch of fresh spinach. Discuss the nutritional value of spinach. Explain that each group will design an experiment that will examine the visual appearance, taste, texture and smell of all three types of spinach.

2. Brainstorm with the class possible methods of observing and recording the different features of the spinach. Set clear objectives for the experiments, such as experimental design, time restraints and data organization. Allow students time to develop their plan.

3. Have students present their plan to you (and/or the class) for approval. Provide feedback for each group and allow students to revise their plan. Students shall wash their hands, conduct their sensory experiments and record observations.



4. Ask students what conclusions they can make based on the information they gathered. Discuss with the class different ways to present the information. Students create graphs and charts to represent their findings.

5. Instruct groups to present their findings to the class. Ask students to explain which type of spinach they liked best and why.

Objective: Students will design an experiment to compare the flavors and textures of spinach, interpreting their findings with charts and graphs.

California Standards

Grade 4: ELA CC: SL.4.4, 5
Math CC: 4.MD.4

Grade 5: ELA CC: SL.5.4, 5
Math CC: 5.MD.2
NGSS: 5-PS1-2, 3, 4

Grade 6: ELA: SL.6.4,5
NGSS: MS-PS1-4

Materials:

- 3 frozen packages of spinach
- 3 cans of spinach
- 3 bunches fresh spinach
- 3 medium-sized pots
- Hot plate
- Water
- Forks
- Plates
- Napkins

Vocabulary:

Encourage students to use these words when making observations.

Aftertaste: the persistence of a sensation of flavors when food is no longer present.

Mouthfeel: food's physical and chemical interaction in the mouth, used often in the testing and evaluating of foodstuffs.

Pungent: having a strong odor that stings the nose, especially in acidic or spicy substances.

Vibrant: of bright color.

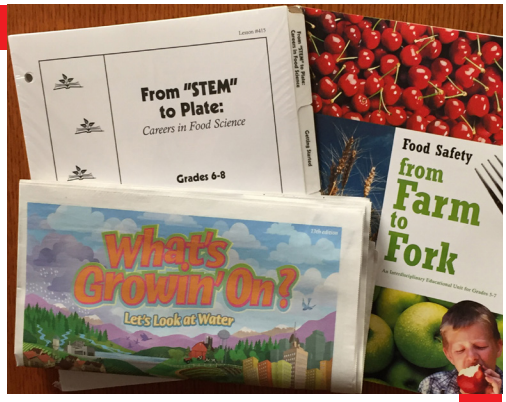
This lesson has been adapted from California Department of Education curriculum by California Foundation for Agriculture in the Classroom.

Pick-A-Peck

Additional Resources

We've included more agriculturally-related teaching resources!

Feel free to use these materials throughout the school year.



Five **Fun Facts** About California Agriculture!

- California has been the nation's top agricultural state for more than 50 years. California agriculture generates approximately $54 billion a year, more than any other state.
- More than 90% of California farms are family farms or partnerships.
- California grows more than 400 agricultural commodities.
- Milk is California's most valuable commodity. Milk production generated $9.36 billion in 2014.
- Over a third of US vegetables and two-thirds of US fruits and nuts are produced in California.

Check out these **Fun Resources!**

- ***What's Growin' On?:*** The 16-page student newspaper provides reading and activities, geared for grades 3-8. One copy of our recent editions is included in the back pocket. Request class sets while supplies last at **LearnAboutAg.org/wgo**.
- **Fact and Activity Sheets:** We offer more than 30 fact sheets, covering a wide range of agricultural topics. Download or request print copies at **LearnAboutAg.org/factsheets**.
- **Invasive Species:** *The Invaders* introduces six invasive species threatening California agriculture. Explore more in-depth resources at **LearnAboutAg.org/invasivespecies**.
- **Plant Nutrients:** Fact and activity sheets explain the essential plant nutrients (NPK)! Explore plant science resources for all ages at **LearnAboutAg.org/resources/learn_plant.cfm**.
- ***Food Safety from Farm to Fork:*** This interdisciplinary educational unit is all about food safety. Explore more units and lesson plans at **LearnAboutAg.org/lessons**.
- **Ag-Bites and WE Gardens:** These one-page resources promote hands-on learning. See the full sets at **LearnAboutAg.org/agbites** and **LearnAboutAg.org/wegarden.**
- ***Farming is Everywhere*:** This educational coloring book is fun for younger students! The coloring book is available for download at **LearnAboutAg.org/resources/teaching.cfm**.
- **Other Resources:** We've included resources from **ChooseMyPlate.gov** and **FruitsAndVeggieMoreMatters.org**. The kiwifruit resource (in the November section) was provided by **HarvestOfTheMonth.com**, a great source for nutrition education resources. The apple lesson (*A is for Apples*) was provided through the National Agricultural Literacy Curriculum Matrix, a collection of materials available at **AgClassroom.org**. For students interested in agricultural career opportunities, check out **AgExplorer.com**.

Questions?

Contact Info@LearnAboutAg.org or 916-561-5625

Learn About Ag®
California Foundation for Agriculture in the Classroom

California

Agricultural Fact and Activity Sheets

Information compiled by California Foundation for Agriculture in the Classroom

These California-specific fact sheets include information about natural resources or commodity production, history, nutrition, top producing counties, and economic values. The activity sheets provide specific lesson ideas and fun facts for each topic. The lesson plan is aligned to current California Education Standards.

- Agricultural Water
- Alfalfa
- Almonds
- Apples
- Artichokes
- Asparagus
- Avocados
- Beef
- Bees
- Bell Peppers
- Blueberries
- Cantaloupe
- Cherries
- Citrus Fruits
- Cling Peaches
- Corn
- Cotton
- Cut Flowers
- Dairy
- Dried Plums
- Dry Beans
- Eggs
- Forest Resources
- Fresh Carrots
- Green (Snap) Beans
- Herbs
- Invasive Species
- Lettuce
- Mushrooms
- Pears
- Pickling Cucumbers
- Pistachios
- Plant Nutrients - Nitrogen
- Plant Nutrients - Phosphorus
- Plant Nutrients - Potassium
- Pork
- Poultry
- Processing Tomatoes
- Rice
- Spinach
- Strawberries
- Table Grapes
- Walnuts

Top 10 Ways to Use Agricultural Fact and Activity Sheets

1. **Ag Literacy Events**
   Information and fun activities for young students who are just starting to learn about agriculture.

2. **Bulletin Board Ideas**
   Assign each student a different commodity or natural resource. Students design a weekly bulletin board and engage their peers in a related activity.

3. **World Geography Connection**
   Where did these California commodities originate? Students create a world map, illustrating country of origins.

4. **History Connection**
   Highlight the dates mentioned on each commodity sheet. Create a timeline that goes all around the classroom, using words and images to record these significant moments in agriculture.

5. **Math Connection**
   Students use numbers found within the facts sheets to create an appropriate graph of their choice. For example, create a pie chart representing the percentage of clingstone peaches that are used for fruit cocktail, are canned and are eaten fresh.

6. **Agricultural Marketing**
   Students use the information on fact sheets to develop jingles, billboards, and commercials. Discuss the importance of a strong and positive marketing campaign for agriculture.

7. **Agriscience Project Ideas**
   Fact sheets are a wellspring of ideas for researching and experimenting about different agricultural commodities and natural resources.

8. **Language Arts/English Connection**
   Students read the front of the fact sheet and demonstrate their reading comprehension by writing a summary or writing questions and then exchanging with a partner. Students select an agricultural topic and write a research paper using proper grammar and citing of references.

9. **Nutrition Connection**
   Students analyze the nutritional values of various agricultural commodities and explain the human body's use of specific vitamins. Students identify where the commodities fit in the different food groups.

10. **Add some spice to your lessons!** Find a new method for teaching everything from alfalfa to water.

02/19 Learn About Ag

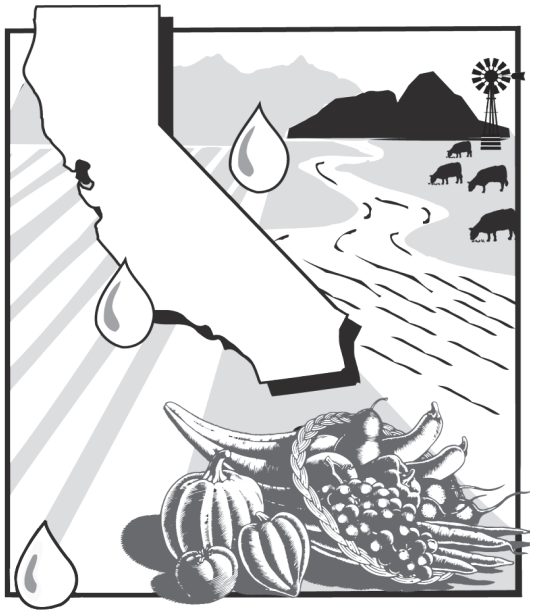
This is one in a series of fact sheets composed by the California Foundation for Agriculture in the Classroom (CFAITC). For additional educational materials: CFAITC, 2600 River Plaza Drive, Suite 220, Sacramento, CA 95833-3293 • (916) 561-5625 • (800) 700-AITC • Fax: (916) 561-5697
Email: info@learnaboutag.org • Website: LearnAboutAg.org

Natural Resource Fact Sheet

Agricultural Water

Information compiled by the California Farm Water Coalition

Sources – California's water supply averages 194.7 million acre-feet per year, statewide. This water comes from rain and snowfall and the Colorado and Klamath rivers. From this supply, the majority is consumed by natural vegetation, leaving 82 million acre-feet available for dedicated use. During an average water-supply year, California farmers and ranchers apply 31.6 million acre-feet of water to grow their crops. Other consumptive uses include the environment at 38.7 million acre-feet and 8.0 million acre-feet for municipal and industrial uses.



The major projects that have been the primary sources of stored water include the Central Valley Project (CVP), State Water Project (SWP), Coachella Canal, All-American Canal, and the Klamath Basin. Construction of the CVP began in 1937 and for the SWP in 1957, with full SWP funding approved in 1960. The delivery of water origininating in northern California from the CVP and SWP has been reduced in recent years due to enviromental regulations that govern the delivery of water through the Sacramento-San Joaquin Delta.

Distribution – Water is available through natural precipitation such as rain and snow. It is then transported throughout the state's numerous waterways, including creeks, streams, lakes, and rivers. Other water is stored underground in porous rock and soil (also called aquifers) and brought to the surface by wells and pumps. Approximately 30 percent of the water supply for farms, homes and businesses comes from groundwater.

Two-thirds of the demand for water comes from the Southern one-third of the state while two-thirds of the precipitation and water storage are in the Northern one-third, creating significant challenges for water distribution.

History – The history of California agriculture and water development are intertwined. The first California agricultural water delivery system was built at Mission San Diego Acala. With the Gold Rush, the state's demand for food grew with its population. As early as 1865, private companies began constructing canals in the Central Valley to irrigate crops. In 1877, the State Legislature passed the Wright Act, authorizing the formation of public irrigation districts. These agencies, formed by local citizens, are responsible for providing a steady, reliable supply of water for irrigation, flood control, recreation, human consumption, and other uses. In the twentieth century, the California Department of Water Resources and the United States Bureau of Reclamation also began storing water and delivering it to farms and cities. This large-scale development of water has allowed California to become a national and world leader in agriculture.

Irrigation Techniques – Simply stated, the term "irrigation" is the process of putting water into the soil to make plants grow. There are three basic ways to irrigate: surface, micro-irrigation, and sprinkler. Surface irrigation includes methods such as border-strip and furrow where water flows on top of the soil. Micro-irrigation techniques, such as drip, bubbler, spray, and subsurface drip, deliver a measured amount of water through an emitter located near each plant. Micro-irrigation techniques can be located above or below ground. Sprinkler irrigation includes the use of a mechanical device which sprinkles water over the crops and simulates rain.

The method of irrigation used depends on many factors including geographical location, crop type, soil type, climate, and economics. Farmers often use laser-leveling of fields, computers, remote sensors, and GPS to improve the efficient use of their water supplies.

Economic Value – Water is an essential component to life and the economy of California. It is vital to the success of California's $47 billion agricultural industry. California has led the nation in farm production every year since 1946. Each of the more than 400 crops grown in California depends upon the availability of water—from the fruits, vegetables and meats people eat to the cotton and wool clothing people wear and the forest and floral products people use and enjoy.

For additional information:
California Farm Water Coalition
(916) 391-5030
Website: www.farmwater.org

California Farm Water Coalition

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Email: info@learnaboutag.org • Website: LearnAboutAg.org

Agricultural Water Activity Sheet

History of Agricultural Water Development in California

Late 1700s - California missions began to irrigate crops for their own consumption. Cattle production dominates commercial agriculture.

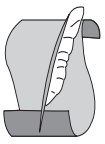
1839 - John Sutter founds New Helvetia (later to become Sacramento) as the first large-scale agricultural operation in the Sacramento Valley.

1848 - James Marshall discovers gold in the American River.

1856 - First commercially developed irrigation project is constructed in Yolo County.

1879 - The California State Supreme Court case Lux vs. Haggin establishes "The California Doctrine" of water rights.

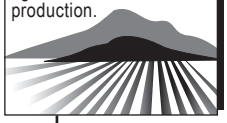
1887 - With the Wright Act, the State Legislature allows the establishment of public irrigation districts. Shortly thereafter, the Turlock, Modesto, and Merced Irrigation Districts are formed.



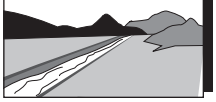
1901 - Colorado River water is first used to irrigate crops in the Imperial Valley.

1940s - First deliveries of irrigation water made by the federally funded Central Valley Project.

1946-Present - California leads the nation in agricultural production.



1960s - First deliveries made by the California State Water Project.



2015 - Exports of California farm products to other countries exceed $21 billion in value.

Lesson Ideas

- Examine the affect of watering duration and frequency on plant growth by manipulating one variable. Beginning with the same amount of water, irrigate one plant with more water less often and one plant with less water more often.
- Fill three plastic cups; one with soil, one with gravel, and one with sand. Predict which cup will hold the most water. Pour water into the cups to test your predictions.
- Discuss the water cycle and how evaporation, condensation, transpiration, and precipitation affect agriculture.
- Place a rain gauge outside your classroom and record the precipitation in your area.
- Research the seasonal rainfall averages in your area.
- Locate newspaper articles that cover local, state and federal water issues. Discuss how they affect the students.

Fantastic Facts

1. Most precipitation in California occurs in Northern California.
2. California's agriculture industry is dependent on the availability of water.
3. The average annual rainfall and snowfall in California is 194.7 million acre-feet.
4. Irrigation is the process of putting water in the soil to make plants grow.
5. Rivers, creeks, dams, canals, and pumps are used to store and transport water.
6. The first water delivery system established for California agriculture was the Mission San Diego Acala.
7. Lasers are used to level irrigated fields with precision.

Lesson Plan: Waterways

Introduction: Surface, sprinkler, and micro-irrigation are the three main types of irrigation techniques used in California. In this lesson, students will deliver water from a source (a bucket) to a field (an aluminum pie plate) and apply the water using an irrigation technique.

Objective: Students will learn about sources of water in their community and construct a model of a chosen irrigation technique.

California Standards: CC ELA: SL.3-12.4, SL.4-8.5; NGSS: 3-5-ETS1-1, 3-5-ETS1-2, 5-ESS3-1, MS-ETS1-3, HS-ETS1-1, HS-ESS3-1

Materials: Buckets, aluminum pie plates, straws, duct tape, sponges, old rags, PVC pipe tubing and fittings, writing paper, butcher paper, markers, and other supplies.

Procedure:

1. Divide students into groups. Have them discuss and write down where they think the water for their community comes from. Discuss their thoughts and clarify the information with facts you have gathered from your local water agencies.
2. Explain that once water is available, it must be delivered to cities and farmlands. Show the students the supplies they have to work with—the bucket of water is the source and the straws, sponges, pipe fittings, etc. are the equipment used to deliver the water to the farm or city (the aluminum pie plate placed a reasonable distance from the souce).
3. Once the students have created a way to transport the water, add soil, which represents the farm or garden that needs irrigating, to the pie plate. Have the students devise a way to efficiently irrigate their crop.
4. After completing the experiment, have each group draw a picture of their model on butcher paper and share their successes and challenges with the class. Compare and contrast the various delivery and irrigation techniques.
5. Invite a local water district representative or a farmer to visit your class to discuss how local water is delivered to homes and farms and how the farms are irrigated.

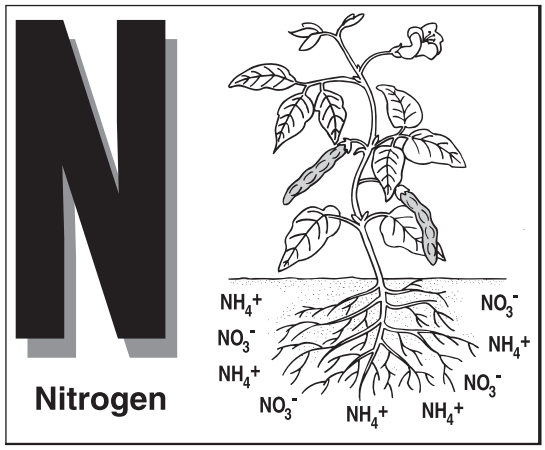
02/19 Learn About Ag This Fact and Activity Sheet was developed by California Foundation for Agriculture in the Classroom in conjunction with California educators and meets the required education standards of the California Department of Education.

Natural Resources Fact Sheet

Plant Nutrients–Nitrogen

Information compiled by the Western Plant Health Association

Plant Utilization – Nitrogen is one of the 17 chemical elements required for plant growth and reproduction. Nitrogen is in chlorophyll, a green chemical which allows plants to capture energy from the sun and make food for themselves in a process called photosynthesis. It is also the basic element of plant and animal proteins, including the genetic material DNA and RNA, and is important in all phases of plant growth.



Production – Nitrogen is an abundant element on and around Earth. Approximately 78 percent of the Earth's atmosphere is nitrogen gas (N_2). As with all plant nutrients, however, nitrogen must be in specific forms to be utilized by plants. Converting N_2 into nitrogen plants can use is called nitrogen fixation. Most often, nitrogen gas is converted into plant available nitrogen by using complex chemical processes or nitrogen-fixing bacteria.

Most manufactured nitrogen fertilizers begin as ammonia. At temperatures of 400ºC - 500ºC and great pressure, nitrogen from the air and hydrogen from natural gas combine to produce ammonia. The ammonia can be used directly or further processed into other nitrogen fertilizers. Legumes, such as beans and alfalfa, grow specialized nodules on their roots. *Rhizobia*, nitrogen-fixing bacteria, live in these root nodules and convert atmospheric nitrogen into nitrogen plants can use. Farmers take advantage of this unique symbiotic relationship by periodically growing legumes in nitrogen-deficient soil to naturally boost nutrient levels.

Forms – In the soil, nitrogen exists in different forms, which interact with one another and with plants, animals and microorganisms. Most crops use nitrogen rapidly, therefore, farmers and home gardeners often supply nitrogen to the plants in a variety of ways, including the application of manufactured fertilizers, applying composts and manures, and growing legumes in rotation with other crops.

Plants absorb nitrogen in the forms of nitrate (NO_3^-) or ammonium (NH_4^+) ions, both of which are water-soluble. Nitrate ions are absorbed quickly by plant roots, but leach easily. Ammonium ions are attracted to soil particles and move slowly through the soil to plant roots. Commercial fertilizers, both dry and liquid, are available with various combinations of nitrate and ammonium ions, enabling farmers to manage their nitrogen application. Crop advisors monitor crops to ensure the crops receive optimum amounts of nitrogen.

History – Americans have fertilized their crops with nitrogen for centuries. Early colonists used animal manure, fish scrap, cottonseed meal, and tobacco stems as nitrogen fertilizer. Later, Americans imported nitrate of soda from Chile, rotated crops with legumes and used ammonium sulfate, a by-product of steel production. Many of these are still used today.

The process of synthesizing ammonia is considered one of the greatest chemical engineering feats. The process was first demonstrated in the laboratory in 1884, but it was not commercially feasible until 1913 in Germany. The first American ammonia plant was built in 1921. Nitrogen fertilizer production was minimal until after World War II, when the demand for food increased with an increase in human population. Improved nitrogen management is the focus of intensive research at both public and private research facilities.

Top Producing Regions – China is the world's largest producer of nitrogen and phosphate fertilizers and Canada produces more potash fertilizer than any other country. Although the U.S. is the third largest producer of nitrogen fertilizers, we still import more nitrogen fertilizer than any other country. Natural gas is a major feedstock for production of ammonia. During this same period 27 U.S. ammonia plants closed. Since 2008, four new ammonia plants have opened but the U.S. remains dependent on nitrogen imports. More than 60% of imported anhydrous ammonia is from Trinidad. Globally, wheat receives the largest share of nitrogen fertilizer at 18.1 percent, however, in the U.S. nearly half (49 percent) of all nitrogen fertilizer is applied to corn.

Economic Value – The economic value of the nitrogen industry is difficult to assess. Many people have businesses associated with replenishing agricultural soils with nitrogen, including those whose livelihoods depend on providing compost bins, soil amendments, and tools. Ammonia production adds $4 billion to the United States economy annually.

For additional information:
California Fertilizer Foundation
(916) 574-9744
Website: www.calfertilizer.org

California Fertilizer Foundation

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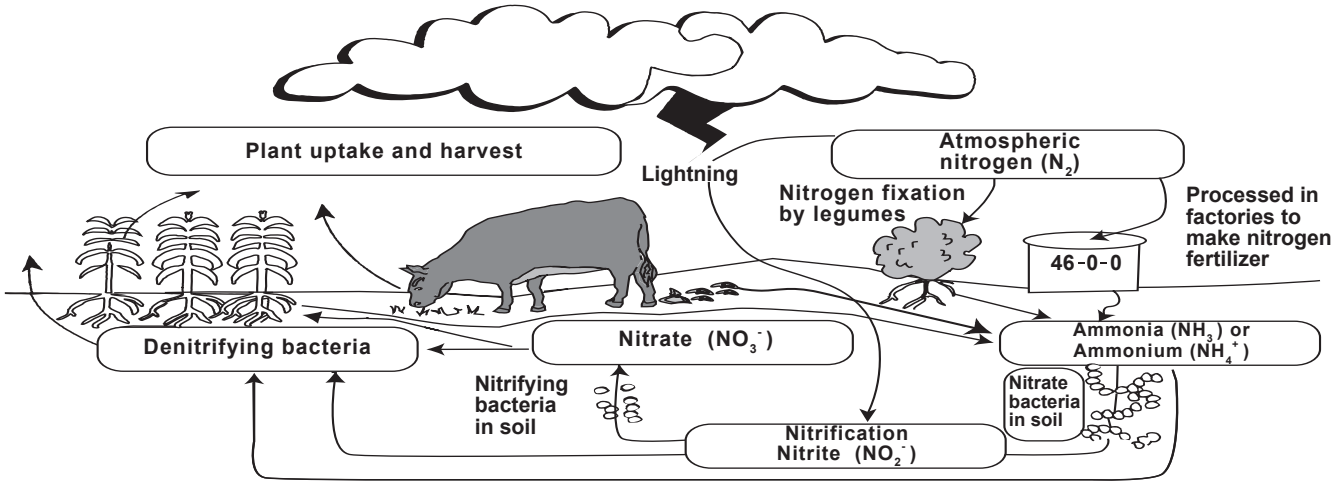
Nitrogen Activity Sheet



Lesson Ideas

- Compare and contrast the nitrogen and water cycles.
- Make a poster of the nitrogen cycle using magazine pictures.
- Chart and compare the growth of plants which are fertilized with varying amounts of nitrogen fertilizer.
- Compare fertilizer labels for nitrogen content.
- Make compost at your school using garden, fruit, and vegetable lunch waste.
- Identify plants which are legumes. Research how these plants make nitrogen available to other plants.
- Draw a picture of a plant and the plant's need for nitrogen.
- Research the procedures and chemical equations used in ammonia fertilizer production.
- Compare and contrast the nitrogen content of various organic fertilizers, including steer manure, chicken manure, and fish emulsion.
- Locate nitrogen on the periodic table of elements. Learn about its physical and chemical properties.

Fantastic Facts

1. Ammonia is the basic chemical ingredient in commercial nitrogen fertilizer production.
2. The color green is associated with plants which contain a sufficient amount of nitrogen.
3. Legumes, such as beans and alfalfa, contain microorganisms in their roots that convert nitrogen into a form other plants can use.
4. NO_3- and NH_4+ are the two forms of nitrogen that plants can absorb through their roots.
5. The United States is the world's top importer of nitrogen.
6. Nitrate (NO_{3-}) is a form of nitrogen that can leach rapidly, depending on environmental factors.

Lesson Plan: Let's Make Manure Tea

Introduction: Substances added to improve the nutrient content of soils are called fertilizers. Fertilizers can be natural or man-made (synthetic). Animal waste is sometimes used as a natural fertilizer.

Objective: Students will make a liquid fertilizer called "manure tea" from steer manure. Students will design and perform an experiment to determine the optimum dilution of this nitrogen-rich fertilizer.

California Standards: NGSS: 3-5-ETS1-3, MS-LS1-5, MS-ETS1-3

Materials: Store-bought steer manure (3 or 4 cups), coffee filter, five-gallon bucket with lid, water, string, index cards cut in half, stapler, tablespoon, corn seedlings and other supplies for student-designed experiment.

Procedure:

1. Write the term "manure tea" on the board. Obtain student ideas for its definition. Also discuss that plants need certain nutrients for successful growth and reproduction.
2. Have each student make a manure tea bag by placing two tablespoons of manure into a coffee filter and stapling it shut. Staple a string to one end and 1/2 of an index card to the other end of the string. Have students create and draw labels for their "brands" of tea on the index cards.
3. Hang the tea bags in a covered five-gallon bucket that is full of water. Let the bags steep overnight. Record observations.
4. Design and perform a class experiment that will determine the optimum manure tea concentration for growing corn. Brainstorm variables to control and potential failure points.
5. At the conclusion of the experiment, compare and identify the most successful design solutions. Discuss how their newly-gained knowledge can relate to large-scale agriculture.

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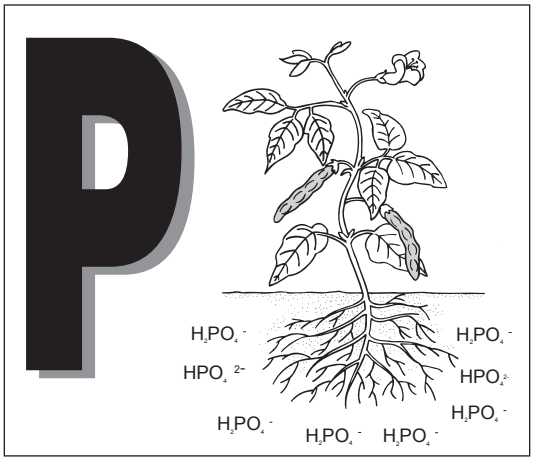
Natural Resources Fact Sheet

Plant Nutrients–Phosphorus

Information compiled by the Western Plant Health Association

Plant Utilization – Phosphorus, one of the 17 chemical elements required for plant growth and reproduction, is often referred to as the "energizer" since it helps store and transfer energy during photosynthesis. It is also part of the genetic material of all cells—DNA and ATP.



All plants require phosphorus during all phases of growth. Most annual plants (plants that grow, reproduce, and die in one year) require large amounts of phosphorus as they begin to grow. Plants grown in cold weather which have limited roots and rapid top growth, such as lettuce, are high phosphorus users. Legumes also require plentiful amounts of phosphorus. Established plants such as trees, shrubs, and vines, especially those grown in warm climates with long summers, require the least amounts of phosphorus fertilizer.

Production – In the soil, phosphorus is often found in chemical forms that cannot immediately be absorbed by plants, so farmers commonly apply phosphorus to the soil. The common source for commercial phosphorus fertilizer is rock phosphate, a calcium phosphate ore found in deposits within the earth. Rock phosphate is usually strip mined and then pulverized. The resulting material is treated with sulfuric, phosphoric, or nitric acid to produce various soluble phosphates that can be used as fertilizers such as monoammonium phosphates, diammonium phosphates, and super-phosphates.

Forms – All plants require phosphorus. Plants most often absorb phosphorus in the form of phosphate ions $H_2PO_4^-$ and sometimes as HPO_4^{2-}. These phosphate ions react readily with the soil and become part of the soil particles in a process called "fixation." Fixation prevents the leaching of phosphorus, but also changes it to a form that plants cannot use. The challenge in agriculture is to provide plants with the proper amount of phosphorus, in the proper form, at a time when the roots will absorb it.

The phosphorus concentration in fertilizer is reported as P_2O_5 and is represented by the middle number of the three numbers listed on the label. Manufactured fertilizers come in liquid and granular forms. Organic fertilizers, such as manure, contain phosphorus in limited quantities. Growers usually apply phosphorus directly near the root zone. This is called banding and makes the phosphorus available for immediate absorption by the roots. Growers often mix phosphorus in soil when planting seedlings or transplanting trees, shrubs, or vines.

History – Early American farmers used ground bones as fertilizers, however, very little of the phosphorus in the bones was available to the plants. In 1808, Sir James Murray of Ireland produced the first effective phosphorus fertilizer. Murray treated bones with sulfuric acid, converting the phosphorus to phosphate, a form of phosphorus plants can absorb. Murray later discovered that rock phosphate could be used in this same process.

Super phosphate production began in the United States in South Carolina in 1849. In 1851, John Jay Mapes of Long Island, New York, built the first phosphate manufacturing plant in the United States. Thus, he earned the title of "Father of the American Fertilizer Industry." By 1889, America produced 90 percent of the world's phosphate fertilizer and continues to produce 30 percent of the fertilizer produced today.

Top Producing Regions – In 2008, China led the world in phosphate production with 35 million tons, followed by the U.S. with 31 million tons, and Morocco/Tunisia with 28 million tons. The U.S. remains the leading exporter of phosphate fertilizers. In 2009, China led all countries in annual phosphate fertilizer consumption with 10 million metric tons followed by India which consumed more than five million tons and the U.S. with more than four million tons.

In 2007, Florida and North Carolina accounted for 85 percent of the total domestic output of phosphate rock. Production also occurs in Idaho and Utah. India and China are the major destinations for United States exports of phosphate fertilizers.

Economic Value – The economic value of the phosphate industry is difficult to assess. The fertilizer value alone is more than $3.5 billion, but the additional value associated with this industry for mining and food production greatly exceeds this value.

For additional information:
California Fertilizer Foundation
(916) 574-9744
Fax: (916) 574-9484
Website: www.calfertilizer.org

California Fertilizer Foundation

02/19 Learn About Ag

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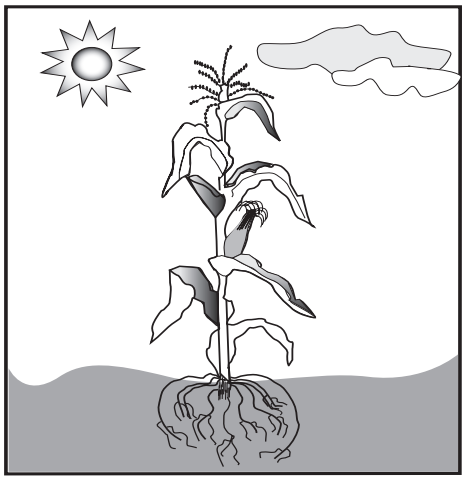
Email: info@learnaboutag.org • Website: LearnAboutAg.org

Phosphorus Activity Sheet

How Phosphorus Functions in Plants

- *Stimulates early growth and root formation and growth.*
- *Necessary for cell division and DNA and RNA formation.*
- *Improves the ability of plants to absorb water and other nutrients.*



- *Stimulates flower blooms and seed development.*
- *Improves plant strength and the ability to tolerate unfavorable environmental conditions.*
- *Aids in photosynthesis and food formation.*

Lesson Ideas

- On a United States map, color the states yellow that mine rock phosphate.
- Learn about the physical and chemical properties of phosphorus.
- Research and list foods high in phosphorus and learn how phosphorus is used in the human body.
- Interview a nursery or greenhouse worker and ask when and how phosphorus should be applied to your favorite plants.
- On a world map, color the major phosphorus producers one color and the major phosphorus importers another.
- Research how phosphorus rock is processed into phosphate fertilizer.
- Invite farmers into your class to discuss how plant nutrients are added to their particular crops.
- Create a comic strip whose main character is “Phosphorus—the Energizer.”

Fantastic Facts

1. Plants require the most phosphorus at the beginning of life and during periods of rapid growth.
2. The largest phosphorus producer is China.
3. Plants that have small root systems and significant above ground growth require plentiful amounts of phosphorus fertilizer.
4. Before rock phosphate, ground bones mixed with dilute sulfuric acid provided plants with phosphorus.
5. Florida and North Carolina produce the most rock phosphate in America.
6. P is the symbol for the element phosphorus.
7. The middle number on a fertilizer label represents the amount of phosphorus it contains.

Lesson Plan: Read the Label

Introduction: Fertilizer labels have a standard format which lists three numbers. Each number represents the quantity of a nutrient in the fertilizer. The first number represents the percentage of nitrogen (N) in the particular fertilizer. The second number represents the percentage of phosphorus (P_2O_5), and the third number represents the percentage of potassium (K_2O) in the fertilizer.

Objective: Students will examine fertilizer labels, research the nutrient needs of an agricultural crop, and create a fertilizer label for that crop.

California Standards: CC ELA: SL.3-12.3; NGSS: 5-LS1-1, MS-LS1-5

Materials: Fertilizer labels, white paper, markers, reference books.

Procedure:

1. Distribute sample fertilizer labels. In groups, have students examine the labels. As a class, create a template for a standard fertilizer package. Discuss what the three numbers mean on the front label.
2. Have each student select a crop for which they will find out its nutrient requirements. They may use encyclopedias, the Internet, a local agricultural commissioner’s office, or information from the University of California Cooperative Extension.
3. Have students create fertilizer labels that would meet the nutritional needs for their crop. Students may need to specify the time frame for application, such as “at planting.”
4. As a class, compare the fertilizer labels the students developed. Could one fertilizer be used for more than one commodity? Discuss what other factors might be considered when determining what fertilizer to purchase—price per unit, package size, soil type, climate, availability of composts and manures.
5. Invite an agronomist or fertilizer manufacturing representative to your class to discuss the uses and sales of fertilizers. After the presentation, identify the speaker’s claims, point of view, and reasoning.

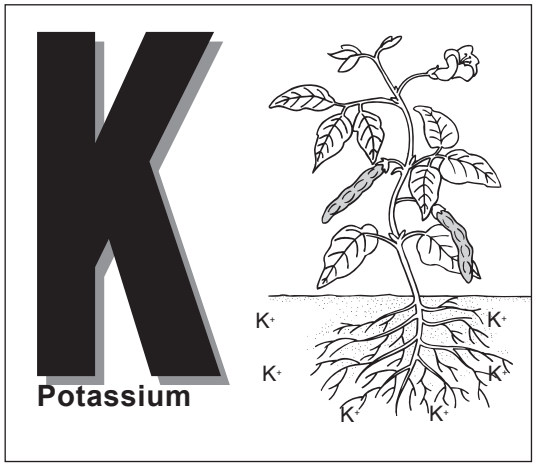
02/19 Learn About Ag This Fact and Activity Sheet was developed by California Foundation for Agriculture in the Classroom in conjunction with California educators and meets the required education standards of the California Department of Education.

Natural Resources Fact Sheet

Plant Nutrients–Potassium

Information compiled by the Western Plant Health Association

Plant Utilization – Potassium, one of the 17 chemical elements required for plant growth and reproduction, is often referred to as the "the regulator" since it is involved with more than 60 different enzyme systems in plants. Potassium helps plants to resist drought and effects from excessive temperatures. It also increases crop resistance to disease. Potassium aids plants in the production of starches, controls root growth, and regulates the opening and closing of pores in plant cells (called stomata), which is important for efficient water use.



All plants require potassium, especially crops high in carbohydrates, like potatoes. Studies have shown that adequate amounts of potassium may promote the growth of long, strong cotton fibers; increase the shelf life of fruits; increase the stem length and quantity of roses; enhance the green color and growth of turf grass; and increase the size and quality of fruits, grains, and vegetables.

Production – Potassium is the seventh most abundant element in the Earth's crust, yet only one to two percent is available to plants. The rest is incorporated in the structure of the rocks and unavailable to plants. Farmers often apply potassium fertilizer for optimum plant growth.

Most potassium is mined from underground deposits and is shaft mined, like coal. Some shafts are drilled as deep as 3,000 feet. In some cases, solution mining is also used in which case water is pumped into the shaft to dissolve the ore. The solution is extracted and allowed to evaporate, leaving behind potassium salts. Some potassium comes from the evaporation of water from natural salt lakes, such as the Great Salt Lake in Utah, and the Dead Sea in Israel and Jordan. Tobacco stems, wood ash, wool waste, sugar beet factory waste, and flue dust also contain potassium, but their use as a fertilizer is limited.

Forms – Potassium is symbolized as K_2O on fertilizer labels and is the third number on the label. Plants absorb potassium in the form of the ion K^+ which dissolves readily in water.

Ninety-five percent of all potassium fertilizers come in the form of muriate of potash, also known as potassium chloride. For crops unable to tolerate chloride, potassium sulfate, potassium nitrate, and other chloride-free salts are used. Potassium comes in both liquid and granular form and is usually mixed in the soil or placed directly near the root zones of plants. Application of chloride-free foliar sprays are sometimes used on certain crops.

History – The letter K, used to symbolize potassium, comes from the German word kalium. Before the industrial era, people burned wood and other organic matter in pots to manufacture soap. The ashes were rinsed and the water was allowed to evaporate, leaving a residue of potassium salts. People called the residue "pot ashes" or potash. These salts were boiled with animal fat to produce soap.

In 1868, Samuel William Jackson, a botanist in Connecticut, burned plants and analyzed the ash. Jackson found plants consisted of large amounts of potassium, and other minerals. His work led to the use of fertilizers to promote an increase in crop yields. The very first US patent issued by the United States government was for an improved method of potash production.

Top Producing Regions – Canada leads the world potash fertilizer production and exports, producing nearly 8 million tons in 2009. Russia, Belarus and Germany are also top producers of potash. U.S. production has been stable with most domestic production occurring in New Mexico. Lesser amounts are produced in Utah and Michigan. The price of potash fertilizer has increased significantly in the past few years, causing mining companies to seek new sources of the raw material throughout the world.

China is the world's leading potash consumer, using 8 million tons in 2009. The U.S. and India are the next leading consumers of potash. Approximately 20 percent of the 6.5 million tons of potash used in the U.S. is domestically produced.

Economic Value – United States farmers pay $900 million annually for potassium fertilizers, with California farmers paying, approximately $30 million each year.

For additional information:
California Fertilizer Foundation
(916) 574-9744
Website: www.calfertilizer.org

California Fertilizer Foundation

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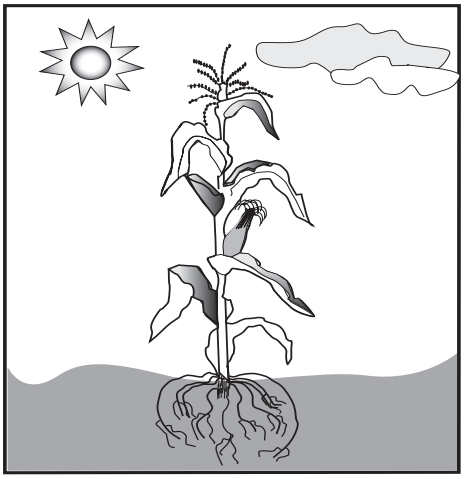
Email: info@learnaboutag.org • Website: LearnAboutAg.org

Potassium Activity Sheet

How Potassium Functions in Plants

- *Helps retard crop diseases.*
- *Builds cellulose needed for stalk and stem strength.*
- *Aids in photosynthesis and food function.*
- *Increases root growth and improves drought resistance.*



- *Produces grain rich in starch.*
- *Necessary for plant protein formation.*
- *Reduces water loss and wilting.*
- *Assists many enzyme actions.*

Lesson Ideas

- On a world map, color the major potassium exporters blue and the major importers red.
- On a map of North America, locate and color the areas where potassium is mined.
- Research how humans utilize potassium and find out what foods are high in potassium.
- Make a poster illustrating the various roles potassium plays in plant growth and health.
- Locate potassium on the periodic table of elements. Learn about its physical and chemical properties.
- Find two points that are 3,000 feet apart so students can appreciate the depth of some potassium mine shafts.
- Research the Colonial soap-making process and the various uses of potash.
- Find out how agronomists determine the potassium content of soils.

Fantastic Facts

1. Canada is the world's leading exporter of potassium.
2. Potassium is obtained by underground mining.
3. Potassium is sometimes called "the regulator" because it controls many plant enzyme systems.
4. Potassium helps plants by aiding protein and starch formation, stimulating root growth, providing winter hardiness, and opening and closing cell pores called stomata.
5. New Mexico processes the most potassium in the United States.
6. Historically, potassium was called "potash" because it was sourced from the residue found in wood ashes.
7. California is the largest importer of potassium.
8. Some potassium is obtained from The Great Salt Lake in Utah.
9. The very first US patent issued was for an improved method of potash production.

Lesson Plan: The World of Potassium

Introduction: Potassium is an essential nutrient for plants and animals. It also has many other uses, depending on its chemical formulation.

Objective: Students will research potassium and its various uses. They will create a wall-length mural that depicts their findings.

California Standards: CC ELA: W.3-12.7; RI.3.5; RI.4-5.9; RST.6-10.2, 7

Materials: Reference materials, including encyclopedias, human nutrition books, plant nutrient requirement books, butcher paper, paint or markers, glue.

Procedure:

1. Write the following phrases on index cards: plants which produce fibers for clothing; annual crops, such as celery; forage crops, such as alfalfa; tubers, such as potatoes; disinfectant; human nutrition; component in soap; plant guard cells; potassium forms which are usable by plants; agricultural by-products which contain potassium; roses and other flowers.
2. Divide the students into groups of three or four and distribute one index card to each group.
3. Each group is responsible for researching how potassium relates to the key words on the index card. After they gather the details, the group is to decide how they will depict their knowledge on a wall mural called "The World of Potassium."
4. In a class discussion, determine what the class mural will look like so that all aspects of potassium use will be displayed.
5. Have each group create their graphics and text for the mural and then place it on the mural.
6. Display the mural at a science night or in the library. This may be displayed with other murals made for other elements, such as nitrogen and phosphorus.

02/19 Learn About Ag This Fact and Activity Sheet was developed by California Foundation for Agriculture in the Classroom in conjunction with California educators and meets the required education standards of the California Department of Education.

Food Safety from Farm to Fork

An Interdisciplinary Educational Unit for Grades 5-7

Why Teach About Food Safety?

Americans enjoy the safest food supply in the world, yet the most common intestinal ailments in the United States are caused by foodborne illnesses. How can this be?

Food Handling Is The Key!

This unit provides fifth through seventh graders a better understanding of food safety through real-life examples and enjoyable activities. They learn that everyone has a responsibility in minimizing foodborne illnesses—farmers, transporters, restaurants, grocery stores… and the consumer! Through reading, games, puzzles, math problems and science investigations, participants identify the roles each one of us plays to ensure the food we enjoy is safe to eat.

The majority of foodborne illnesses associated with fresh fruits and vegetables is due to improper food handling at the foodservice or consumer level.

Food gathering and preparation have changed over time. Americans have gone from growing and preparing their own food to enjoying convenience foods grown by a fewer number of farmers and prepared by someone other than themselves. Thus food safety practices are important in every stage of food production, preparation, and consumption. Here are a few examples of food safety practices from each area.

The Farm

Good Agricultural Practices have been developed jointly by the agricultural industry and government. These provide guidelines that reinforce already stringent laws governing food safety on U.S. farms.

A small percentage of foodborne illness outbreaks can be traced back to the growing, packing, shipping, or processing of fruits and vegetables.

The Food Handlers

Grocery stores, transportation companies, storage facilities and restaurants have food safety rules and require employees to abide by them. Stringent regulations imposed by national, state and local governments, based on sound science, ultimately benefit the consumer.

Did you know? It is common to find bacteria on produce, but this bacteria is not harmful to people.

The Consumer

This educational guide is part of a consumer food safety education program. The consumer, the person who eats the food, is responsible for making sure that the food is prepared and stored properly. This is crucial since most foodborne illness outbreaks are associated with improper handling at the restaurant or home.

Nutrition! Throughout the lessons, discuss the importance of eating right. The human body has natural defense mechanisms that work best when we eat right, get plenty of exercise, drink lots of water and get enough sleep!

So take a look through the guide. See how you can use it to teach your students about foodborne illnesses and reduce the number of foodborne illness incidents. At the same time your class will practice reading and writing, investigate and experiment, apply math to real situations, and practice thinking critically about a topic that impacts all of us daily—food safety!

Links to Current California Standards

Students learn and retain information best when they can relate what they learn in the classroom to their personal lives. This multidisciplinary, thematic unit on food safety includes lessons that teach or reinforce many educational standards for California Public Schools. Each activity includes a listing of the specific standards addressed. Refer to the California Department of Education Website (www.cde.ca.gov) for descriptions of the educational standards.

Table of Contents

PLAYING IT SAFE

Description

Students will learn the basic science of food safety and the importance of safe food practices while playing a board game, performing "fact or opinion" and "cause and effect" activities, and then writing an essay on what they learned.

Activity

1. Explain that students will learn about the science of food safety.
2. Discuss the differences between "facts" and "opinions." Select students to read dictionary definitions of these two terms.
3. Have students number a piece of paper from 1-6. Instruct them to listen to the statements that you read to them. They are to write an "F" next to the number if they think the statement is a fact, and an "O" if the statement is an opinion. Read the statements below, one at a time, and have the students record their answers. Discuss the answers.

Fact or Opinion?

❑ F ☑ O 1. People should only eat cooked foods since, according to a media report, all bacteria in food are harmful.

☑ F ❑ O 2. Microorganisms can live almost anywhere, even in food.

☑ F ❑ O 3. To maintain your health, it is important to eat five or more servings of fruits and vegetables per day.

☑ F ❑ O 4. A single bacterium is too small to see without a microscope.

☑ F ❑ O 5. Scientific research has shown that the mishandling of food by the person who prepares or eats it accounts for most foodborne illnesses.

❑ F ☑ O 6. People should not eat fresh foods since your aunt says they can carry bacteria like *E. Coli* and *Salmonella*.

4. In preparation for the game, orally read *What's All the Talk About Food Safety?*
5. Create groups of three to four students. Explain *Playing it Safe* and then have the students play the game.

Directions:

a. Shuffle the playing cards and place them face down on the board.

b. Place the sponge markers on "Start."

c. The first player draws a card from the top of the stack, reads it aloud, and then moves the number of spaces directed. All students should listen to the fact stated on the card, making a mental note that the statement is indeed a "fact." If a person must move "back" but is already on "Start," then the player should remain on "Start."

d. The next player takes a turn. Continue until one player crosses the finish line. Reuse the cards, if necessary.

6. Remind students that a "cause" is something that makes something else happen. What happens is the "effect." Have groups do the *Cause and Effect* activity located on the game board. Students should agree on the answers and discuss as a class.
7. Have each student write a three paragraph essay that covers the following information. Once written, have students edit for proper grammar, spelling, and punctuation, including capitalization.

a. What is food safety and why is it important to use safe food practices?

b. Define "foodborne illness" and provide specific examples of foodborne illnesses.

c. Describe several things a person could do to prevent foodborne illnesses.

Time

One 50-minute session

Materials

For teams of 3-4:

- Four ½" pieces of sponge; four colors
- *What's All The Talk About Food Safety* Student Page (page 4)
- *Playing It Safe!* Game Board (page 5)
- *Playing It Safe!* Game Cards (page 6)

California Standards

Common Core English Language Arts

Grade 5
RI.5.5
W.5.2
SL.5.1
L.5.1, 5.2

Grade 6
RI.6.7
W.6.2
SL.6.1
L.6.1, 6.2
RST.6.8

Grade 7
RI.7.3
W.7.2
SL.7.1
L.7.1, 7.2
RST.7.8

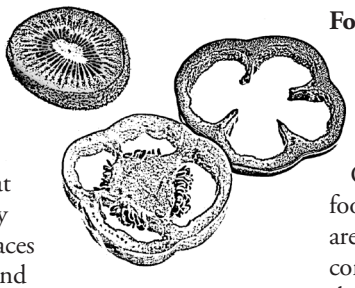
CAUSE & EFFECT ACTIVITY ANSWER KEY

No.	Cause	Effect
1	not refrigerated	turned sour
2	washed hands	healthful salad
3	warm summer temperatures	more foodborne illnesses
4	added rennet (bacteria)	made cheese
5	core in bin	decomposed to compost

What's All the Talk About Food Safety?

Did you ever have an upset stomach or something that people call the 24-hour flu? If your symptoms lasted less than a day, chances are your brief illness was caused by a foodborne illness. You will learn about ways you can minimize the number of foodborne incidents you have in your lifetime.

What is a foodborne Illness?



A **foodborne illness** is a disease that is carried to animals or humans by food. Foodborne illnesses are caused by microorganisms such as bacteria. Not all bacteria cause disease in humans. Those that do are called **pathogens**. They grow rapidly when conditions are right—dark, damp places where temperatures range between 40° F and 140°F. Any type of food can be a source of a foodborne illness; however, high protein foods are responsible for most of them. Examples include milk and milk products, eggs, meats, poultry, fish, seafood, and soy protein food such as tofu.

What is food safety ?

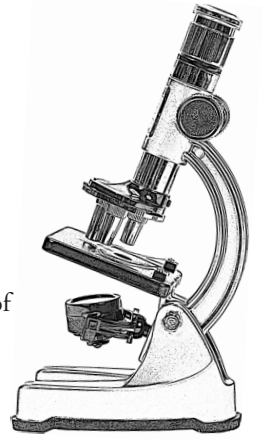
Food safety is the practice of making sure that people have the healthful food they need for an active, healthy lifestyle. Some foods, particularly fresh fruits and vegetables, are not cooked before we eat them. These foods must be handled correctly to make sure they are safe to eat. The Centers for Disease Control reports the majority of foodborne illnesses associated with fresh fruits and vegetables are due to improper food handling at the foodservice or consumer level. They are contaminated with pathogens and then not cooked or stored properly. Since you handle food, you can do your part to keep your food safe.

Who is responsible?

All people have a personal responsibility to keep food safe. Farmers are the first people responsible for producing healthful food. They must know how to plant, cultivate, irrigate, harvest, and store the food so that the final product is safe for the consumer. Farmers are responsible for making sure that the people involved in their operations follow the guidelines established by the United States Department of Agriculture (USDA). In the 1990s, the agricultural industry adopted some guidelines called GAPs—Good Agricultural Practices—that keep food safe at the farm level.

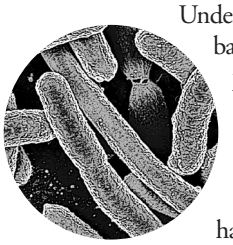
People who pack, process and transport food must make sure that food is kept at proper temperatures, and handled and washed appropriately. Storage facilities must be kept clean. Grocers and those who prepare and serve food at restaurants are responsible for using proper food safety procedures. You, the at-home consumer, must do your part too! It requires teamwork.

What is a microorganism?



Microorganisms, also known as microbes, are single-celled organisms so tiny that millions of them can fit between the eye of a needle. Individually, they can only be seen with a microscope. Colonies of microorganisms, such as mold on bread, may be visible with the eye alone. Common microbes associated with foodborne illnesses are bacteria.

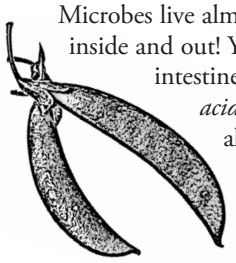
Bacteria Out of Control!



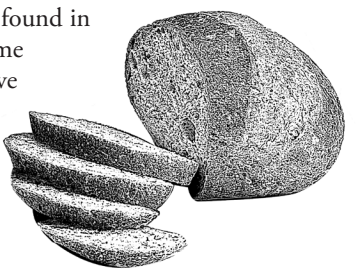
Under certain conditions, a bacterium can double in population every 10 to 30 minutes—usually in warm, damp and dark places. People can get sick when they eat foods that have been contaminated by harmful bacteria. *Salmonella* and *E. Coli* are common bacteria that cause foodborne illnesses. Seems funny that one form of *E. Coli* is inside our gut, but if we eat another form, it can make us sick. That's strange but true!

Since pathogens can live almost anywhere, it is important to clean, separate, chill, and cook your food properly… and then eat it in a timely manner.

Beneficial Microbes



Microbes live almost everywhere! In fact, you are covered with microbes inside and out! Your mouth contains more than 600 kinds! Your large intestine contains *Escherichia coli*, a bacterium. *Lactobacillus acidophilus* turns milk into yogurt. *Saccharomyces cerevisae*, also known as yeast, makes bread rise. *Bacillus thuringiensis (Bt),* a natural pesticide, is found in the soil and is used by farmers and home gardeners. Rhizobia are bacteria that live in the nodules of some plant roots, such as beans and alfalfa, and convert nitrogen into a form plants can use. Without microbes to decompose things, the world would be covered with waste. In fact, Earth as we know it would not exist!



PLAYING IT SAFE

START

CARDS

Sneezed on food. Miss one turn

END

Cause and Effect

Read each of the following statements. Underline the "cause" and circle the "effect."

1. The milk was not refrigerated, so it turned sour.
2. Miguel washed his hands before making a tasty, healthful salad.
3. There are more foodborne illnesses in the summer because bacteria multiply quicker in warmer temperatures.
4. Grandma made cheese after adding rennet to milk.
5. Sandra threw her apple core into the outdoor bin so it would decompose and become compost.

PLAYING IT SAFE GAME CARDS

Instructions: Copy and cut one set of game cards for each group.

		You used a clean paper towel to wipe off the kitchen counter and then disposed of it properly. MOVE AHEAD 3 SPACES.
You washed your hands for 20 seconds with warm water and soap before helping make dinner. MOVE AHEAD 3 SPACES.	You pet your dog and let him lick your hand. Then you helped mom cut up lettuce for the salad without washing your hands. GO BACK 2 SPACES.	You used a scrub brush to wash under your fingernails before preparing dinner. MOVE AHEAD 4 SPACES.
You cooked your scrambled egg until all of it was firm. MOVE AHEAD 3 SPACES.	You washed your cutting board under hot soapy water after cutting the eggs, but before you started slicing the potatoes for the salad. MOVE AHEAD 3 SPACES.	You were tired, so you left the potato salad on the counter for 2 hours before putting it away. MOVE BACK 2 SPACES.
When your dad barbecued, you washed the raw meat juices off the platter with warm soapy water before he put the cooked meat back on it. MOVE AHEAD 3 SPACES.	You washed the plastic cutting board in the dishwasher after dinner. MOVE AHEAD 4 SPACES.	You washed your hands but a towel was not close by. You wiped them on the legs of your pants. MOVE FORWARD 2 SPACES, THEN BACK 2 SPACES.
You cut up the chicken for fajitas with a sharp knife and then cut your veggies without rinsing the knife or cutting board. MOVE BACK 4 SPACES.	Before talking on the phone, you helped your mom put the leftovers in the refrigerator as soon as dinner was over. MOVE AHEAD 3 SPACES.	You put your dish sponge in the microwave on high for one minute before you wiped off the counter. MOVE AHEAD 3 SPACES.
You asked the bag clerk at the supermarket to put the chicken in a separate bag from your fruits and vegetables. MOVE AHEAD 4 SPACES.	You cut up cheese slices but didn't clean the cutting board when you finished. MOVE BACK 2 SPACES.	You let the kitchen sponge soak in the dishwater overnight. In the morning you wiped down the counter with it. MOVE BACK 3 SPACES.
Mom called and asked you to put the ground beef out to thaw. You placed it on the counter top all day to defrost. MOVE BACK 3 SPACES.	As your chicken defrosted in the refrigerator, the juices dripped onto the refrigerator shelf. An apple rolled into the juices. MOVE BACK 3 SPACES.	Your steak was barely warm and looked under-cooked when you went out to dinner with your friends. You didn't want to say anything, so you ate it anyway. MOVE BACK 2 SPACES.
You dried the dinner dishes with the cloth that had been hanging all week on the refrigerator door. MOVE BACK 3 SPACES.	You remembered to tie back your hair while you were making a cake for your brother's birthday. MOVE AHEAD 3 SPACES.	You understand the importance of keeping hot foods hot and cold foods cold, and not cross-contaminating raw food with cooked food. MOVE AHEAD 4 SPACES.

OPERATION KITCHEN IMPOSSIBLE

Description

In this lesson, students become the head chef in a virtual kitchen. They will use mathematical knowledge, problem-solving skills and food safety guidelines to prepare a safe and nutritious meal.

Activity

Part 1: Introducing Food Safety

1. Brain Dump! Ask students, "What can we do to keep food safe?" Give students 30 seconds to capture their ideas on a personal sheet of paper. Capture thoughts on a common share sheet.
2. Instruct one student to read Chef Al's recipe card (pg. 8) out loud.
3. Divide students into four collaborative working groups. Assign each group one of the four safety tips below. Each group is to develop and present a 30-second song, rap, or poem sharing important information about their safety tip. Divide a large class into eight groups and feature each tip twice.
4. After each presentation, have the class identify an anchoring movement to recall the important concept presented. For example, students may make a motion with their hand like they are opening the refrigerator door to represent the First In, First Out (FIFO) principle.

Part 2: Applying What We Know

1. Lead students in a review of safety tips and anchoring movements.
2. Have students work individually or with a learning partner to complete the scenario- based problems on the Operation Kitchen Impossible handout (page 8). Students should use a separate sheet of paper to solve problems and record answers.
3. Don't forget it! Have one student read problem 10 of the handout about farmers and ranchers' commitment to food safety. Challenge each student to share with the class one personal commitment to food safety.

ANSWER KEY

1) a. ¼ hour; b. 1½ hours; c. ¾ hour
2) 20°
3) 159°
4) 142.5 pounds beef
5) 25.5 gallons milk
6) 6 bags
7) x = 2 cups
8) 48 ft.^{2}
9) 6 oz. solution
10) Answers will vary by student.

Safety Tips

Buy it Cold—Keep it Cold!

Take food straight to the fridge after buying. Choose packages tightly wrapped without tears or holes. Freeze fresh meat if you can't use it within two days. Defrost meat in the refrigerator or using the microwave—don't leave it out!

FIFO!

When storing meat, label each package with the date and item. Practice the FIFO system, First In (the fridge), First Out!

Heat it Up Before You Eat it Up!

Foods must reach a certain temperature to be considered safe. Keep these in mind: poultry 165˚, ground beef 160˚, beef roasts and steaks 145˚, pork 160˚, leftovers 165˚.

Separate—Don't Cross-Contaminate!

Keep raw meat, poultry and seafood away from other foods to prevent the spread of bacteria. Use separate cutting boards for meat and other foods. Always wash your hands and food preparation areas with soap and water before and after use.

Time

Part 1: 60 minutes
Part 2: 30-45 minutes

Materials

For class as a whole:

- Share sheet
- Markers
- Safety tips, cut out (4)

For each student:

- *Operation Kitchen Impossible* handout
- Personal sheet of paper
- Pencil
- Calculator (if desired)

California Standards

Common Core English Language Arts

Grade 5
SL.5.2, 5.5

Grade 6
SL.6.2, 6.5

Grade 7
SL.7.2, 7.5

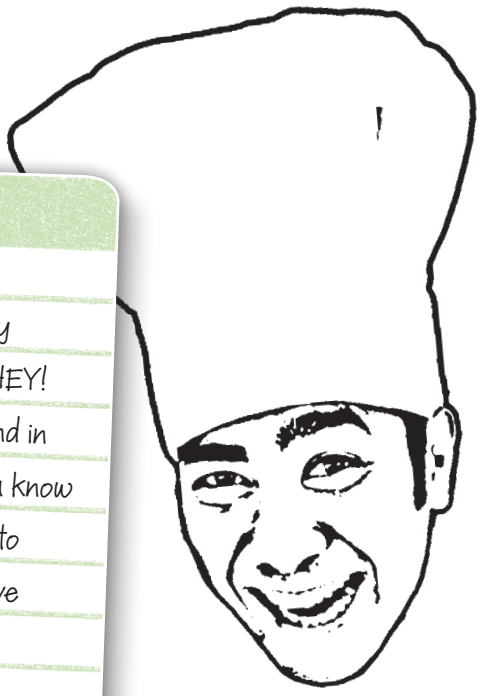
Common Core Mathematics

Grade 5
5.NF.3
5.NF.6
5.NF.7

Grade 6
6.RP.3
6.EE.2
6.G.1

Grade 7
7.NS.2
7.NS.3
7.EE.3
7.EE.4
7.G.6

OPERATION KITCHEN IMPOSSIBLE



HELP! My name is Chef Al Fredo and I have been taken by hungry kidnappers who want my secret recipes! Tonight my restaurant, "HEY! PASTA BOWL TO ME!" will be full of guests, and I need you to stand in as head chef. I trust you will create safe and delicious food! Did you know that foodborne illness is often due to bacterial contamination linked to how the food is handled? Next to each light bulb in my kitchen I have important safety reminders. Read them first and then get cooking!

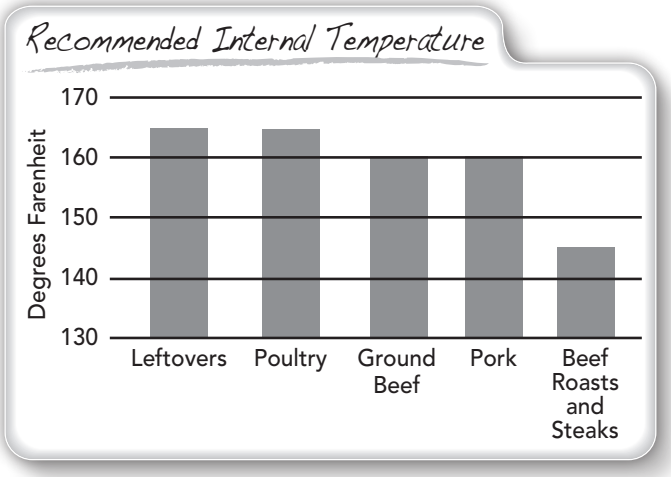
– Chef Al

Warming up!

1. Cooking food for the appropriate length of time is important in food safety! Chef Al left these times in code, by writing them as decimals. Convert the following cooking times from decimals to fractions.

A) 0.25 hours B) 1.5 hours C) 0.75 hours

Use the graph on the right to answer questions 2 and 3.



2. What is the difference in recommended internal temperature between poultry and beef steaks?

3. What is the average internal temperature for all foods listed?

Now you're cooking!

4. Chef Al warned you not to leave too much food out or it will spoil. He uses 95 lbs. of beef for 200 people, but tonight you are expecting 300 people. How many pounds of beef should you put in the fridge to thaw?

5. Dairy products need to be refrigerated so they don't go bad. Calculate how many gallons of milk you will need to make Chef Al's famous Alfredo sauce. He uses 17 gallons to serve 200 people, but you are expecting 300.

6. You pull out frozen pizza dough from the freezer that Chef Al has carefully labeled with the contents, date and amount of dough. You need 15 lbs. of dough to thaw for dinner. If each bag weighs 2½ lbs. how many bags do you need to take out of the freezer?

On fire!

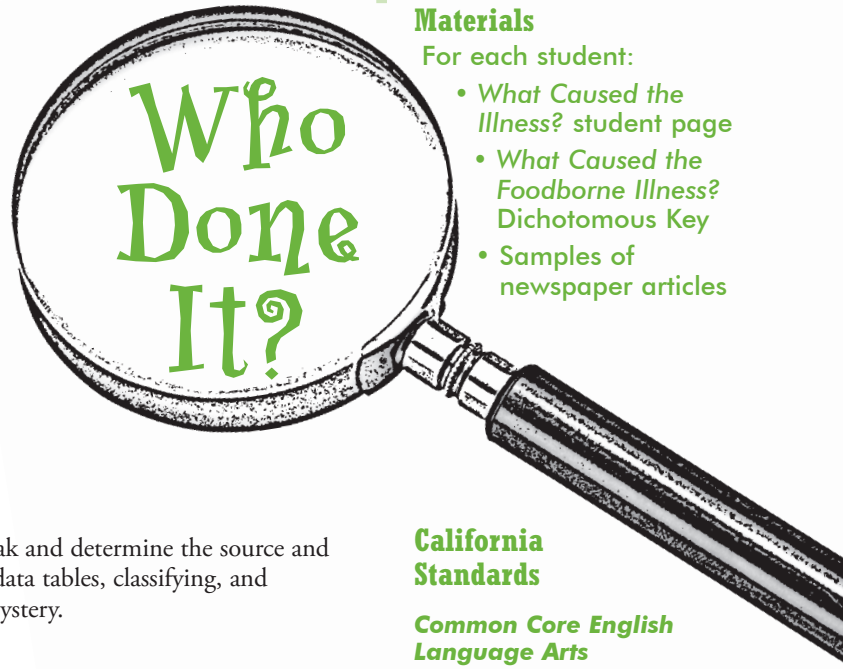
7. Chef Al left his pasta recipe in a secret code. For the amount of flour, Chef Al wrote $2(3x+4) = 20$. Solve for the variable to determine how many cups of flour are needed.

8. Make sure you don't cross-contaminate! You must clean the counter in the kitchen before you begin preparing food. The counter is 4 ft. wide and 12 ft. long. What is the area of the counter?

9. The antibacterial cleaning bottle says that you need ½ ounce of solution for every 4 square feet of surface area. Using your answer from problem 8, how many ounces of antibacterial solution do you need to make sure your counter is clean?

10. American farmers and ranchers are committed to continued research in the area of food safety. What is your food safety commitment? Take a moment to write down three specific actions you will take to commit to food safety in your home.

Mighty Microbes



Time
Two 50-minute sessions

Materials
For each student:
- *What Caused the Illness?* student page
- *What Caused the Foodborne Illness?* Dichotomous Key
- Samples of newspaper articles

Description
Students, acting as epidemiologists, look at the facts of an outbreak and determine the source and cause of an illness that makes many picnickers sick. Interpreting data tables, classifying, and reading are incorporated into this investigative epidemiological mystery.

Activity
1. Explain to the students that they will become epidemiologists and determine the cause of an illness that affected many people in a community. Have someone read the dictionary definition for "epidemiology" and discuss its meaning. Also, discuss that actual epidemiology cases are much more complex than the hypothetical case they are about to analyze.
2. As a class read the foodborne illness outbreak scenario on page 10.
3. Discuss the terms "outbreak" and "dichotomous," as well as any others the students may find difficult. Create a class vocabulary list if necessary.

Have student duos complete the activity as described on the student worksheet.

NOTE: Have newspaper articles handy for students to use as a guideline for writing their news article as described on page 10.

ANSWER KEY

The unhealthy microbes in the fruit juice were most likely transmitted by an ill worker who had a foodborne illness himself. His improper handling of the cups and juice, along with warm temperatures, spread the disease to the juice. The dichotomous path used to reach this conclusion is: 1a, 2a, 3a, 4a, 5a.

California Standards

Common Core English Language Arts

Grade 5
R.5.4, 5.7
W.5.2, 5.4
L.5.2, 5.4

Grade 6
R.6.4, 6.7
W.6.2, 6.4
L.6.2, 6.4
RST.6.3, 6.7

Grade 7
R.7.4
W.7.2, 7.4
L.7.2, 7.4
RST.7.3, 7.7

Next Generation Science Standards

Grades 6-7
MS-LS1-5

Local Health Department Conducting Investigation!

What Caused the Illness?

Name _____

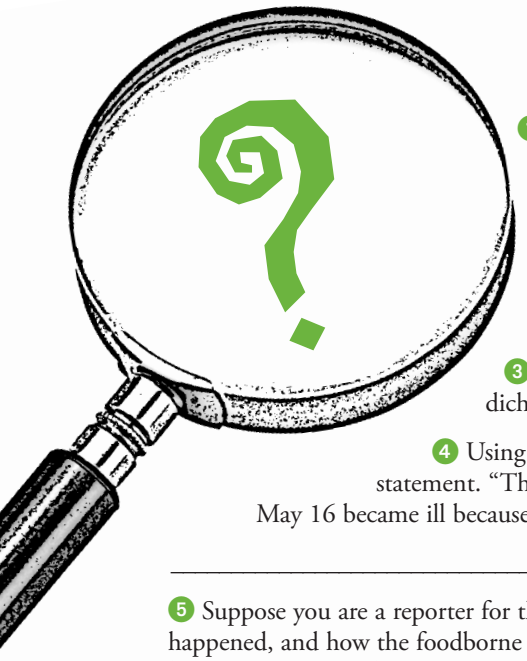
Scenario

The local hospital has treated numerous people for dehydration due to uncontrollable vomiting followed by diarrhea. The county health department is conducting an investigation to determine the causative agent. It was determined that all the patients ate at a community get-together on May 16 and that the illnesses were caused by a foodborne pathogen, a disease-causing microorganism obtained from something the people ate or drank. Look at the data chart above. Each of the 20 people in the chart were hospitalized. Determine what food was responsible for the food poisoning.

PATIENT DATA CHART:

Patient	Hot Chocolate	Fruit Juice	Bottled Water	Granola Bar	Popcorn	Cut Vegetables	Veggie Dip	Watermelon
A	-	+	+	-	-	-	-	-
B	-	-	+	+	+	+	+	+
C	+	+	-	-	-	-	-	-
D	+	+	+	-	-	+	+	+
E	-	+	-	-	-	-	-	-
F	-	-	+	-	+	+	-	+
G	-	+	+	-	-	-	-	-
H	-	+	-	+	-	-	-	-
I	-	+	-	-	-	-	-	-
J	+	+	-	-	+	-	+	+
K	-	+	+	+	-	+	+	+
L	-	+	-	-	+	+	+	-
M	+	+	-	-	-	+	-	-
N	-	+	+	+	-	-	-	-
O	-	+	-	-	-	-	-	+
P	-	+	-	-	-	-	-	+
Q	-	+	-	-	-	-	-	-
R	+	+	-	-	+	-	-	-
S	-	+	-	-	-	-	-	-
T	+	+	-	+	-	+	-	-

+ = that person ate item - = that person did not eat item



1. From the data above, what food do you suspect caused the illness?

_____

2. In one complete sentence, describe your reasoning.

_____

_____

3. Discuss your reasoning with the lead epidemiologist (your teacher) and then obtain the dichotomous key to continue your investigation.

4. Using the dichotomous key, determine the actual source of the illness. Complete the following statement. "Through scientific investigation, my team has determined that the people at the get-together on May 16 became ill because:

_____

5. Suppose you are a reporter for the local newspaper. Write a three to five paragraph article that describes what happened, why it happened, and how the foodborne illness could have been avoided. Before writing your story, examine a newspaper article to see how it is set up. Make sure your article has:

- a headline
- authors listed
- facts of what happened
- facts about foodborne illnesses in general
- how this incidence could have been avoided
- quotes from experts or witnesses (pretend you interviewed patients, event planners, food handlers, epidemiologists, etc.)
- been proofed for spelling, capitalization, proper punctuation, sentence structure, and flow of story

What Caused the Foodborne Illness? Dichotomous Key

Instructions: Read number 1. Determine which statement, a or b, best reflects the incident and information. Proceed as directed, until the illness is traced back to its source. This is called a "trace-back," something that epidemiologists do on a regular basis.

1 The fruit juice was made from frozen fruit juice concentrate, which was pasteurized at the plant. Pasteurization is when something is heated to a temperature high enough to kill microorganisms. The can had a batch number of 10394-PR on its end. A bacterial count was determined from a frozen concentrate with the same batch number. Look at the chart above.

Juice Batch Number	Bacterial Count
10393-PR	0 per 3 ml juice
10394-PR	0 per 3 ml juice
10395-PR	0 per 3 ml juice

a. If the bacterial count was 0 in 3 milliliters of juice, the illness was not likely caused by the concentrate itself. Go to 2.

b. If the bacterial count was 1 per 3 milliliters of juice or greater, the illness was likely caused by the bacteria in the concentrate before preparation. Illness came from fruit juice concentrate.

2 Water used to dilute the juice concentrate came from the tap and is tested by the city's Public Works Department on a regular basis. Here are the data for a 3-week period.

a. If the bacterial level of the water was 0 or less, the water was not the cause. Go to 3.

b. If the bacterial level of the water was 1 or higher, bacteria from the water could be the culprit.

Test Performed	May 10	May 17	May 24	Max. Allowable Level
Bacterial Count	None detected	None detected	None detected	None detected
Copper (ppm)	40	30	40	170
Nitrates (mg/l)*	22	19	21	45
Calcium (ppm)**	48.2	41.7	48.1	300
Lead (ppb)***	None detected	None detected	None detected	None detected
Fluoride (ppb)***	110	98	110	2000

* mg/l = milligrams per liter ** ppm = parts per million *** ppb = parts per billion

3 Ice was added to the juice. The ice came from ice cubes made of city water and were made fresh with clean ice cube trays.

a. The ice was probably not the source of illness. Go to 4.

b. The ice could have been the problem.

4 The prepared juice was at the park for the entire event on May 16 from 2 p.m. until 5 p.m. Use the following information gathered from the event manager to make an appropriate choice.

The juice was prepared at noon on May 16th in insulated jugs that each hold 5 gallons. The juice concentrate was frozen at the time it was made and was mixed with tap water. The coordinator made the volunteers wash their hands before making the juice. A few ice cubes were put into the insulated container, which the volunteers rinsed out with hot, soapy water prior to using. It was stored at room temperature until 1 p.m. at which time it was taken outside to the picnic tables. At the event, juice was removed from the container through the push button spout and placed into paper cups. The filled cups were on the table throughout the event. When necessary, new paper cups were filled with juice. The coordinator said that less people attended the event than expected but that everyone had a great time. The event ended at 5 p.m.

a) The juice seemed to be prepared following food safety procedures. Go to 5.

b) The juice was not prepared following basic food safety procedures. Go to 6.

5 A quick survey of the overall health of the workers indicated that one of the workers at the fruit juice station had a severe stomachache and was feverish the night before the event.

a) A sick worker could have spread a foodborne illness to the guests at the event.

b) A sick worker could not have spread a foodborne illness to the guests. Go to 6.

6 Most bacteria grow best between the temperatures of 40°F and 140°F. View the chart below and the description in 4 and determine whether the outside temperature could have aided in bacterial contamination.

a. Outdoor temperatures could have caused contamination.

b. Most likely outdoor temperatures did not contribute to the illness. Go to 7.

Temperatures at Park on May 16	
Time	Temperature
10 a.m.	62
11 a.m.	69
noon	71
1 p.m.	80
2 p.m.	85
3 p.m.	86
4 p.m.	88
5 p.m.	88
6 p.m.	87
7 p.m.	82
8 p.m.	75
9 p.m.	69
10 p.m.	61

7 How the juice was dispensed or stored could be the problem.

a. The juice could have sat in the cup for longer than two hours, as much time as it takes for harmful bacteria to reach a population that could cause illness. Juice that was not kept cool enough was most likely the problem.

b. The illness was caused by something other than handling. Further investigation needs to occur before a probable cause can be determined at this time.

Time

One 30-minute session

10 minutes alternate days, two weeks

Three 50-minute sessions

Materials

- White bread without preservatives, two pieces per team
- Re-sealable plastic bags
- Thermometer
- Dark closet or shoebox with lid
- Hand lenses or microscopes
- Water
- Eye droppers
- Refrigerator access

California Standards

Common Core English Language Arts

Grade 5

W.5.7, 5.10

SL.5.5

Grade 6

W.6.7, 6.10

SL.6.5

RST.6.3, 6.7, 6.8, 6.9

WHST.6.2, 6.7, 6.8, 6.10

Grade 7

W.7.7, 7.10

SL.7.5

RST.7.3, 7.7, 7.8, 7.9

WHST.7.2, 7.7, 7.8, 7.10

Next Generation Science Standards

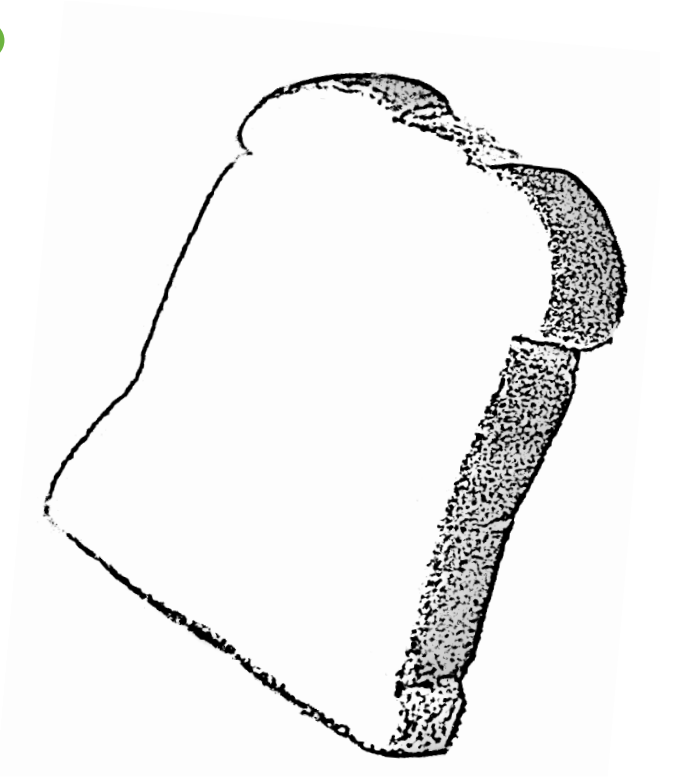
Grade 5

5-PS1-2

Grade 6-7

MS-LS1-5

SO... How Fast Will They Grow?



Description

Students, acting as scientists, will explore bacteria and fungi. They will design an experiment that will promote or minimize the bacterial and fungal growth on a piece of white bread.

Activity

1. Prior to this activity, students should understand what bacteria are and that most are beneficial. Those which cause illness are called pathogens. Review if necessary.
2. Show the students the supplies for an experiment they will design. The goal is to either promote or minimize bacterial/fungal growth on a piece of white bread over a two-week period.
3. Have the students design and complete their experiments, record observations every other day and, after two weeks, write a formal lab report using the guidelines provided.
4. Discuss what is needed for bacteria to grow and what might minimize their growth. Relate this to food preservation and safety.
5. Divide students into teams of three. Assign each group one method of food preservation — drying, freezing, canning, fermenting, smoking, salting, pasteurizing. Using books and on-line sources, they are to:

- Research their assigned form of food preservation
- Learn about its history
- Create a list of examples
- Find out how it is done today
- Create a poster with pictures and words that describes their food preservation process.

!

SAFETY NOTE:

The plastic bags which contain bread must be kept sealed and disposed of properly. Do not allow students to open the bags under any circumstances! Harmful microorganisms could be in the bag.

SO...

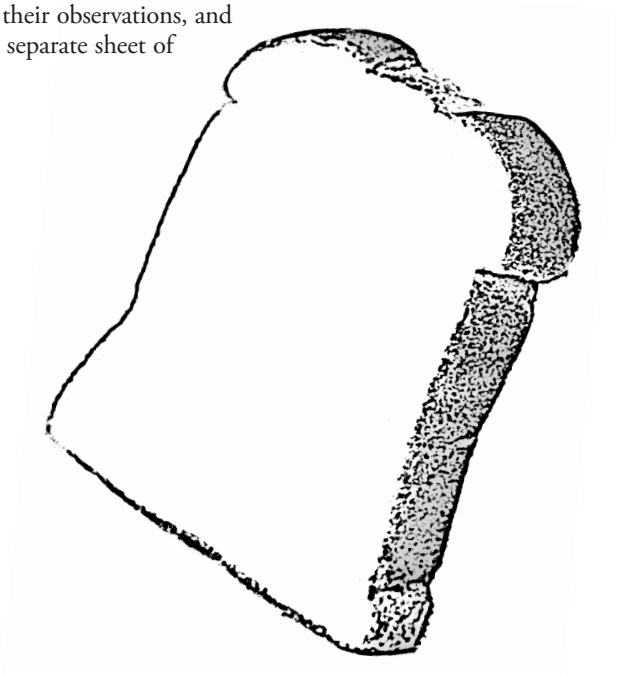
How Fast Will They Grow?

Introduction

Bacteria and fungi are all around us. They are responsible for many things. Most importantly, they decompose dead plants and animals and convert them into soil and nutrients that other living things can use. They are a part of all ecosystems. Some bacteria and fungi, however, can be harmful. These are called pathogens. It important for people to understand how to minimize the amount of pathogens so that the food they eat can be nutritious and safe.

You and your partner are to design an experiment that will encourage or discourage bacteria and fungi from growing on a piece of bread. Before you place it in the plastic bag, you may expose it to a doorknob, backpack, notebook, or even moisture or heat. Or, you may expose it to nothing other than the container it was in. You decide! Design your experiment, have your teacher approve your procedure, and then perform your experiment.

Remember, scientists always create hypotheses, list their procedures, record their observations, and write conclusions. So, as a scientist, you will complete all of these steps on a separate sheet of paper. Here is how your completed write-up should look.

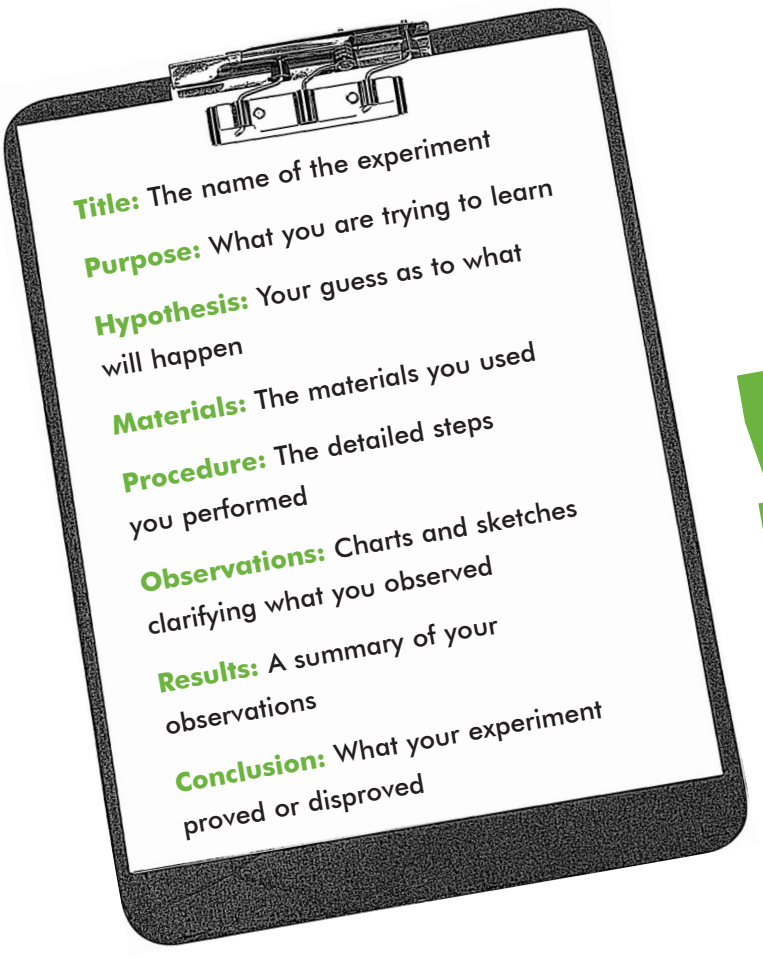


Think About It!

Do bacteria and fungi prefer light or dark places?

What about moisture?

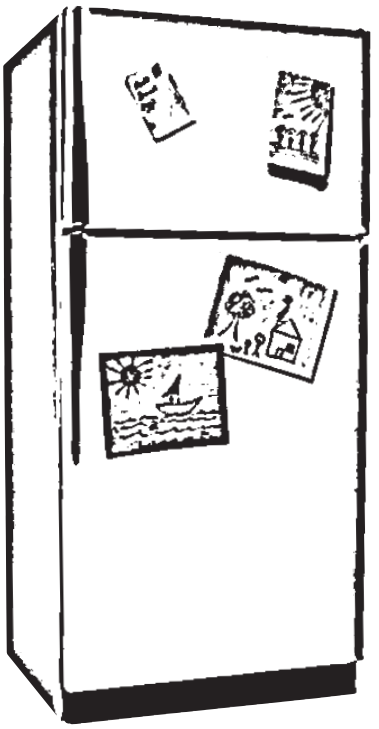
What about heat?



SAFETY NOTE:

Once you place your bread in the plastic bag and seal it, you may not open it under any circumstances. Some bacteria and fungi can be harmful. When finished with the experiment, give your bread, still in the sealed bag, to your teacher for proper disposal. You don't want to get a disease from a pathogen!

How Safe Is Your Kitchen?



Description

Restaurants and school kitchens are inspected each year by state health inspectors. They check to make sure that safe food preparation guidelines are in practice. Inspectors check equipment, storage facilities, and preparation areas.

Food safety should also be practiced at home. Choose a meal. Evaluate your kitchen during its preparation and clean-up by using the form below. Discuss your findings with your family.

Kitchen Inspection Evaluation

Inspector: (your name) _____

Date:_____ Time_____

Meal Inspected (circle one): Breakfast Lunch Dinner Snack

Clean

Food preparer washed hands with warm, soapy water before handling food.	Yes	No
Counter tops were cleaned before use.	Yes	No
Cutting board was cleaned after preparing **each** food item and before going on to the next food item.	Yes	No

Separate to Prevent Contamination

Raw meat, seafood, poultry and other foods were kept separate from each other in the refrigerator.	Yes	No
A separate cutting board was used for meat or the cutting board was washed before a different food item was prepared on it.	Yes	No
Knives and cooking utensils were washed immediately after they came in contact with raw meat or eggs.	Yes	No
Cooked meat was placed on a clean dish.	Yes	No
Raw egg shells were thrown away and any areas where raw eggs were used were washed with soapy water.	Yes	No

Cook to Proper Temperatures

Meat was cooked completely, and hot food was completely heated.	Yes	No

Chill: Refrigerate Promptly

Leftover food was placed in the refrigerator within two hours of preparation.	Yes	No
Food meant to be cold was served cold.	Yes	No

Total number of "Yes" answers: ___ X 10 = _____

Total number of "No" answers: ___ X 0 =_____

Total Score: _____

If your score was:

90-110: You are **"A"** safe cook

70-89: You need to **"B"** a little more aware of food safety procedures.

50-69: You need to **"C"** the food safety rules and use them!

below 50: Sorry, your kitchen has been **"D"**-stroyed by microorganisms!

WHAT'S YOUR GRADE?

Wash Up and Sing! Wash your hands thoroughly with warm, soapy water prior to preparing food. While washing, sing "Happy Birthday" to yourself. This will ensure you have washed your hands long enough to adequately remove dirt, grime and germs.

Be Careful Crossing the Meat! Wash hands, utensils, plates and cutting boards immediately after they have been in contact with raw meat, poultry, seafood or eggs and before they come in contact with any other food, especially fresh produce.

Microwave it! Microwave sponges and dishcloths on high for one minute to remove any harmful bacteria.

When in Doubt, Throw it Out! If you think something may be old or spoiled, throw it out! Follow the old adage: It's better to be safe than sorry—or home with a bad stomachache!

OTHER ACTIVITIES

1. Create flyers which encourage handwashing, proper food preparation and storage. Post in restrooms, lunchrooms and in areas where lunchboxes are stored.

2. Submit student-written editorials to your local newspaper on what the public can do to reduce foodborne illnesses.

3. Create a student-made refrigerator magnet that encourages proper food handling and storage.

4. Check your local public health department website and review inspection reports of your favorite local restaurants.

RESOURCES

Food Safety Music

Carl Winter, Ph.D. has combined his passion for music with his expertise in food toxicology to teach students and adults about food safety. Three CDs are available on a donation basis. Appropriate for all ages.

Carl Winter, Ph.D.
Food Science and Technology Department
University of California
One Shields Avenue
Davis, CA 95616-8598
Phone: (530) 752-2647
Fax: (530) 752-4759
E-mail: *ckwinter@ucdavis.edu*
Website: *foodsafe.ucdavis.edu*

Science and Our Food Supply—Investigating Food Safety From Farm to Table

Kit includes interactive video, comprehensive reference guide, career guide, and varied activities that can be incorporated into all curricula. Separate guides for middle school and high school science teachers.

National Science Teacher's Association

Website: *www.nsta.org/conferences/fda.aspx*

Your Game Plan for Food Safety: A Fight BAC!® Food Safety Education Program for 4th, 5th and 6th Grade Classrooms

This comprehensive program includes video, posters, experiments, activities, home survey, take-home BAC-Catchers, and a teacher's activity and experiment guide.

It is available free from the Fight BAC!® website. Grades K–3 and 9–12 curricula also available.

Fight BAC!®

Website: *www.fightbac.org*

LITERATURE

Capeci, Anne, Bruce Degen, John Spears and Joanna Cole. ***The Giant Germ.*** Scholastic, 2001.

Cobb, Vicki. ***Dirt & Grime, Like You've Never Seen.*** Scholastic, 1998.

Latta, Sara. ***Food Poisoning and Foodborne Diseases.*** Enslow Publishers, Inc., 1999.

Leavitt, Judith Walzer. ***Typhoid Mary.*** Beacon Press, 1997.

Satin, Morton. ***Food Alert!: The Ultimate Sourcebook for Food Safety.*** Checkmark Books, 1999.

Woods, Michael and Mary B. Woods. ***Ancient Agriculture.*** Runestone Press, 2000.

WEBSITES

Alliance for Food and Farming:
www.foodandfarming.info

California Department of Education:
www.cde.ca.gov

California Foundation for Agriculture in the Classroom:
www.LearnAboutAg.org

Centers for Disease Control:
www.cdc.gov

Fight BAC!®:
www.fightbac.org

Food Detectives Fight BAC!®:
www.fooddetectives.com

Food Safety Information and Inspection Service:
www.fsis.usda.gov/food_safety_education

FoodSafe:
foodsafe.ucdavis.edu

Gateway to Government Food Safety Information:
www.foodsafety.gov

MicrobeWorld:
www.microbeworld.org

LearnAboutAg®
California Foundation for Agriculture in the Classroom

For additional educational resources, contact CFAITC
2600 River Plaza Drive, Suite 220
Sacramento, CA 95833
(800) 700-AITC (2482)
www.LearnAboutAg.org

California Foundation for Agriculture in the Classroom (CFAITC) is a non-profit, 501(c)(3) organization dedicated to spreading awareness of agricultural literacy and an appreciation for the safe, fresh and abundant agricultural products we are fortunate to enjoy in California. The Foundation provides educators with free and low cost teacher-tested and standards-based resources.

CALIFORNIA BEEF COUNCIL

cdfa CALIFORNIA DEPARTMENT OF FOOD & AGRICULTURE

ALLIANCE FOR FOOD & FARMING
Your information source on food safety and farming

Tasty Testing

Grades 9-12

Investigate what influences your decision about what you buy to eat.

Materials

- Three to five different kinds of pears
- Small cups for sampling
- Chart paper to collect brainstormed criteria
- Sticky dots or markers for voting

Tip

Try taste tests using other products.

Preparing Taste Test

1. Explain that consumers make decisions that are influenced by a variety of criteria including appearance, taste, advertising, and cost.

2. Brainstorm a list of criteria that would make a good pear (size, color, variety, taste, texture). Have students vote for which criteria they think is most important.

3. Prepare the pears for the taste test by cutting enough for each student to taste each variety. Serve immediately or treat with lemon juice to prevent browning.

5. Place each pear variety (3-5) on a separate numbered plate.

6. Have students taste each pear and rank them based upon the criteria they determined was the most important.

7. Discuss the results from the taste test.

Classroom Activities

English Language Arts

- Write a new advertising jingle for the winning product highlighting the criteria. Create a 30-second commercial highlighting the product and present it to the class.
- Conduct a market test and write an article with artwork for a consumer report that explains the results. Create a marketing plan, including packaging and target audience.
- Research the career of a marketer. How do these professionals help producers and consumers? Interview someone who has a marketing job.
- If students have a hard time determining what is the most important criteria for the taste tests, have a classroom debate to decide which is the most important.

California Standards

Grades 9-12

ELA CC: SL.9-12.1; W.9-12.2

This lesson can be easily adapted to meet the educational standards for a variety of grade levels.

This is one in a series of Ag-Bites developed by CFAITC. Ag-Bites meet the standards of the California Department of Education.
2600 River Plaza Drive, Suite 220, Sacramento, CA 95833-3292 • (800) 700-AITC • info@LearnAboutAg.org • LearnAboutAg.org

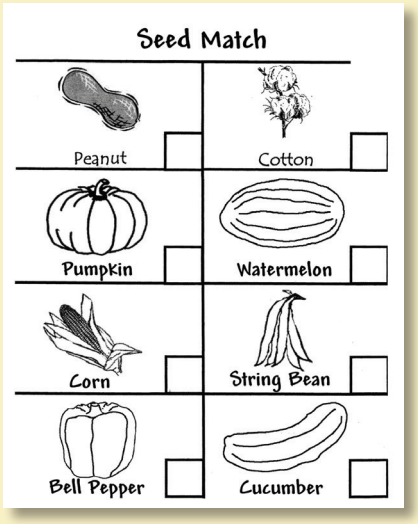
WEGarden

Grades 1-3

1 UNDERSTANDING HOW PLANTS BEGIN AS SEEDS

Seed Match

Make one copy of the seed match worksheet for each student. Create your own based on the model or download from **LearnAboutAg.org/WEGarden**.



1. Have students look at the commodities on the worksheet. Discuss the name of each, determine how each one is part of a healthy diet or used in daily life.

2. Present students with corresponding seeds in an egg carton or sorting box. Discuss the size, shape and appearance of each seed. Have students share their observations.

3. Challenge students to select seeds from the sorter and place each seed on the picture of the commodity to which it corresponds.

4. Cut or break open each whole commodity and locate the seeds within. Allow students to make corrections on the worksheets by moving seeds.

5. Have students glue seeds in correct locations on their worksheets and color each commodity correctly.

6. Count the number of seeds in each commodity. Add up all the seeds in the class. Create math word problems using your results.

Students will understand that the fruits and vegetables we eat and many materials we use come from flowering plants, and that all flowering plants begin as seeds.

California Standards

Grade 1: ELA CC: SL.1.1
Math CC: 1.NBT.1
NGSS: 1-LS1-1

Grade 2: ELA CC: SL.2.1
Math CC: 2.OA.1
NGSS: 2-LS2-2

Grade 3: ELA CC: SL.3.1
Math CC: 3.OA.1
NGSS: 3-LS-1

This lesson can be easily adapted to meet the educational standards for a variety of grade levels. You can also incorporate these seeds into math lessons!

Materials:

- Seed Match worksheet
- Commodities depicted on worksheet
- Seeds from selected commodities
- Egg carton or sorting box
- Crayons or markers
- Glue

Vocabulary:

Help your students brainstorm adjectives to describe seed characteristics.

Coat: smooth, rough, dry, wet, spiky, soft, hard, sticky, etc.

Color: dark, light, black, brown, white, tan, grey, etc.

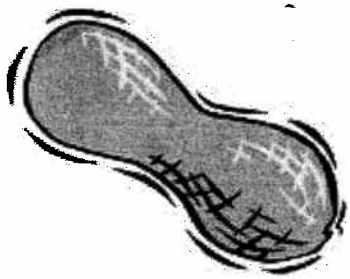
Shape: oval, round, teardrop, etc.

Size: small, medium, large, inches, centimeters, compare to size of a coin, a pencil's eraser, a water drop, etc.

Other questions: Does it have a scent? What does it sound like when you shake it in a cup or eat it? How does the external covering protect the seed? How might animals help disperse seeds?

This lesson has been adapted from California Foundation for Agriculture in the Classroom curriculum. For additional educational resources, visit *LearnAboutAg.org*.

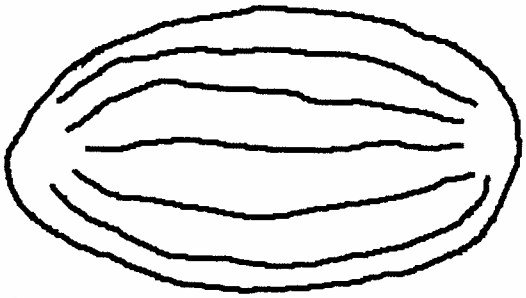
Seed Match



Peanut

Cotton

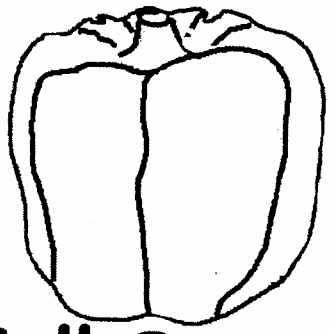
Pumpkin



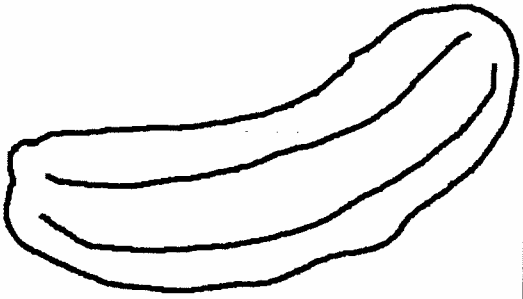
Watermelon

Corn

String Bean



Bell Pepper



Cucumber

Reasons for the Seasons

Have you ever wondered why you can buy fresh melon in December, but you can't seem to grow it in your garden? See if you can arrive at a reasonable answer to this question by using the information and investigations on this page.

California Spotlight

California's mild temperatures and Mediterranean climate make it an ideal location for producing a wide variety of agricultural commodities (more than 400), some of which cannot be produced anywhere else in the nation.

Northern Hemisphere

What's growing in...

June/July	Dec/Jan
Blueberries	Lettuce
Melon	Cauliflower
Grapes	Apples
Peaches	Broccoli
Tomatoes	Peas

Make Your Own Sundial

A sundial is a device that tells time using the position of the sun. To make your own, find the center of a paper plate and make a small hole. Force a pencil through the hole. Place your sundial outside. Use tape or a small stone to keep it **stationary**.

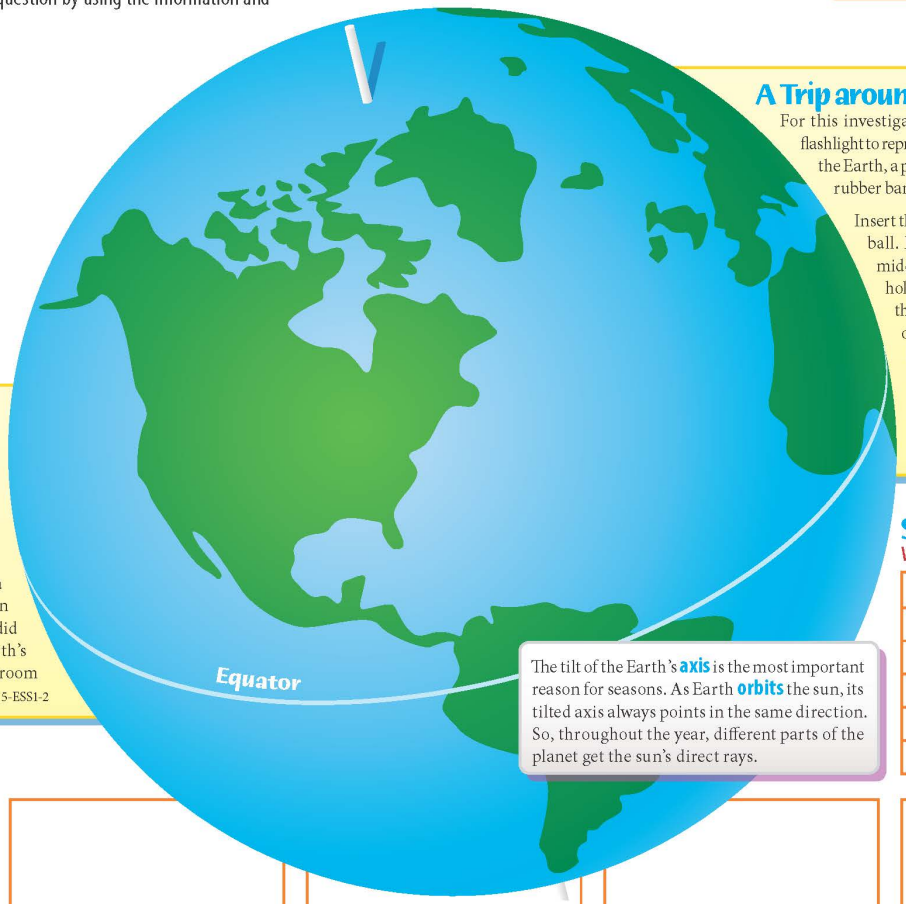
The pencil will create a shadow on the plate. Use a marker to trace the shadow and record the time on the edge of the plate. Repeat every hour. What did you notice? What does this tell you about the earth's movement? Do you see anything else in the classroom that resembles your sundial? Standard: NGSS: 5-ESS1-2

The Four Seasons of Farming

California crop farmers are busy year-round. Here are some typical tasks a farmer completes throughout the year. Add your own drawings to illustrate what happens on the farm during each season. Stds: CA Visual Arts: Grade 3-8: 2.0

Did You Know?

June 21 marks the day when the Earth is turned the most toward the sun. This is known as summer solstice. It is the longest, sunniest day of the year.



A Trip around the Sun

For this investigation, you will need a lightbulb or flashlight to represent the sun, a foam ball to represent the Earth, a pencil to act as the Earth's axis, and a rubber band to represent the equator.

Insert the pencil in the bottom of your foam ball. Place the rubber band around the middle of the foam ball. Have one person hold the light source stationary. Holding the pencil at a constant angle, have the other partner move earth around the light source. Reflect on these questions: What do you notice about the way the light hits the Earth? When is it most light? When is it darkest?

Standard: NGSS: MS-ESS1-1

The tilt of the Earth's **axis** is the most important reason for seasons. As Earth **orbits** the sun, its tilted axis always points in the same direction. So, throughout the year, different parts of the planet get the sun's direct rays.

Southern Hemisphere

What's growing in...

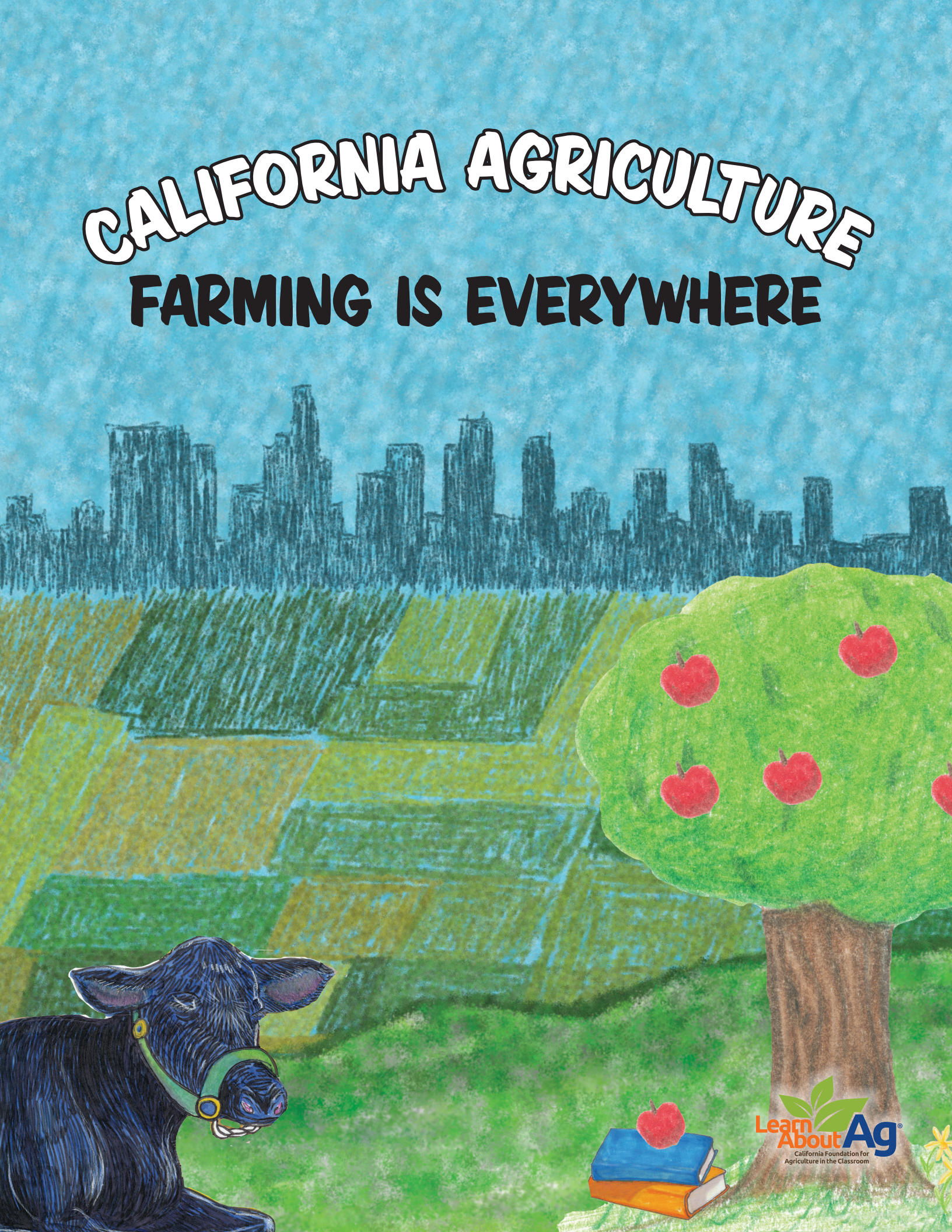
June/July	Dec/Jan
Broccoli	Tomatoes
Lettuce	Peaches
Beets	Cucumber
Cabbage	Strawberries
Cauliflower	Cherries

Spring	Summer	Fall	Winter
Preparing the ground, planting, and hiring employees	Watering, weeding, and fertilizing	Harvesting, transporting, and processing	Planning, making a budget, and buying equipment

Sources: NASA (*nasa.gov*)
National Geographic (*nationalgeographic.com*)
Harvest of the Month (*harvestofthemonth.cdph.ca.gov*)

CALIFORNIA AGRICULTURE

FARMING IS EVERYWHERE



Learn About Ag®
California Foundation for Agriculture in the Classroom

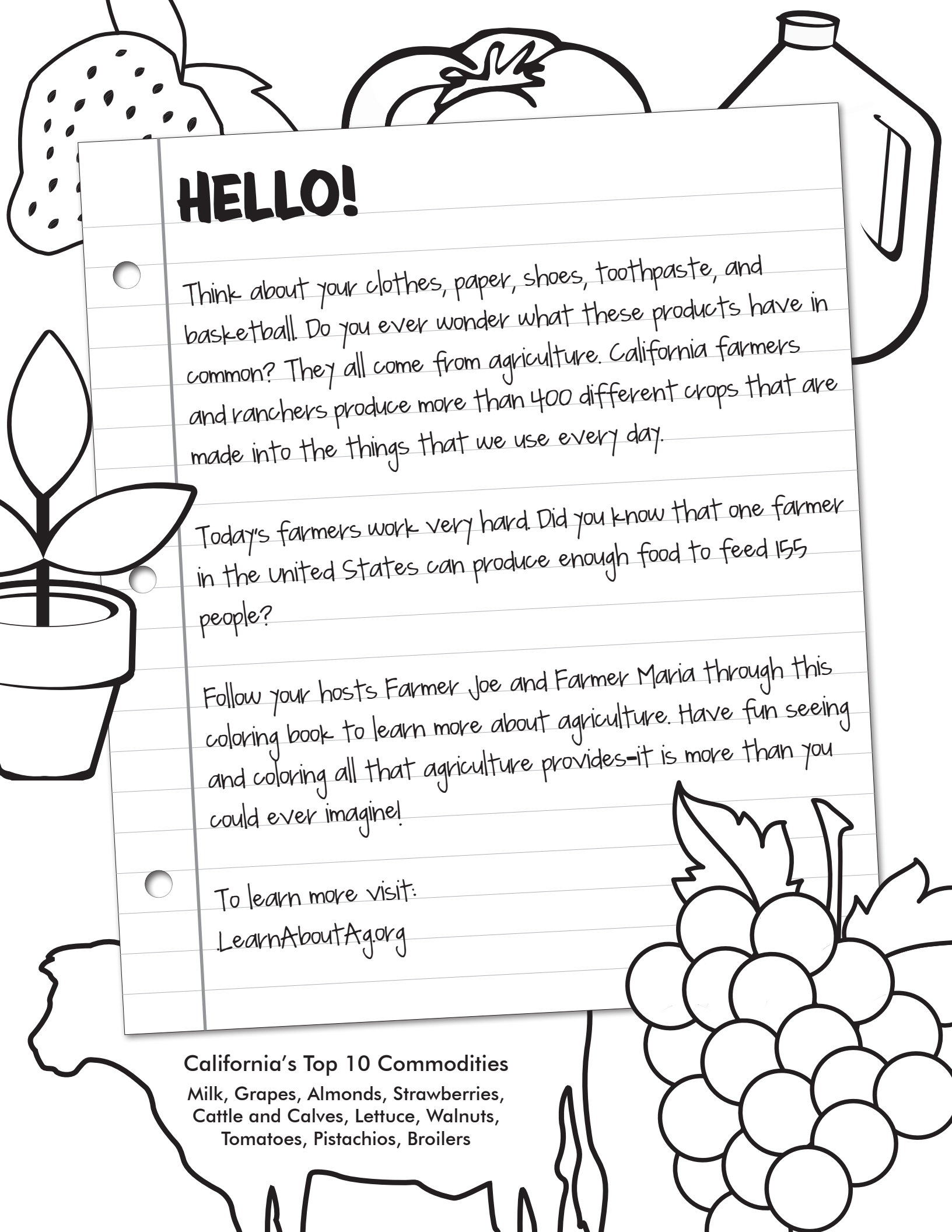
HELLO!

Think about your clothes, paper, shoes, toothpaste, and basketball. Do you ever wonder what these products have in common? They all come from agriculture. California farmers and ranchers produce more than 400 different crops that are made into the things that we use every day.

Today's farmers work very hard. Did you know that one farmer in the United States can produce enough food to feed 155 people?

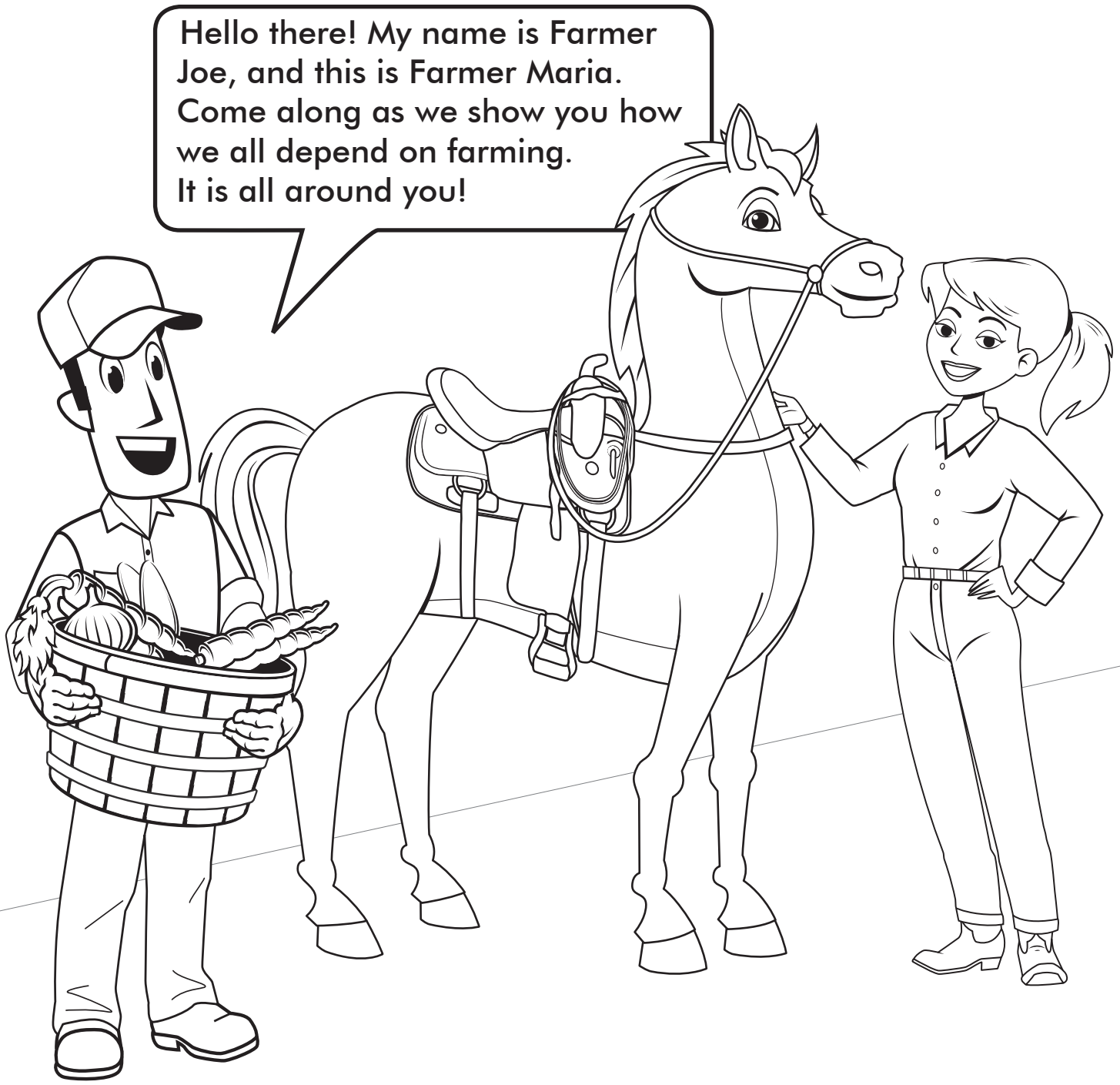
Follow your hosts Farmer Joe and Farmer Maria through this coloring book to learn more about agriculture. Have fun seeing and coloring all that agriculture provides-it is more than you could ever imagine!

To learn more visit:
LearnAboutAg.org



California's Top 10 Commodities

Milk, Grapes, Almonds, Strawberries, Cattle and Calves, Lettuce, Walnuts, Tomatoes, Pistachios, Broilers



Here is an easy way to remember what agriculture is:

The Five F's

FOOD

FUEL

FIBER

FORESTS

FLOWERS

FOOD

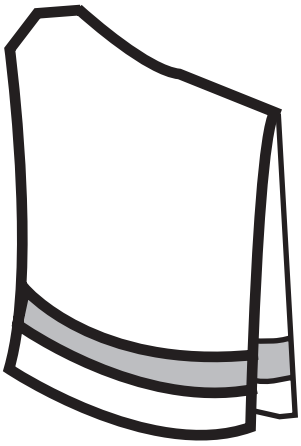
Farmers and ranchers grow many different kinds of FOOD… from the strawberries growing in fields to the hamburger on your dinner plate.

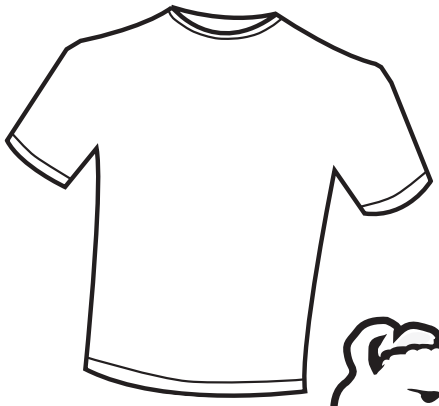
Fun Fact

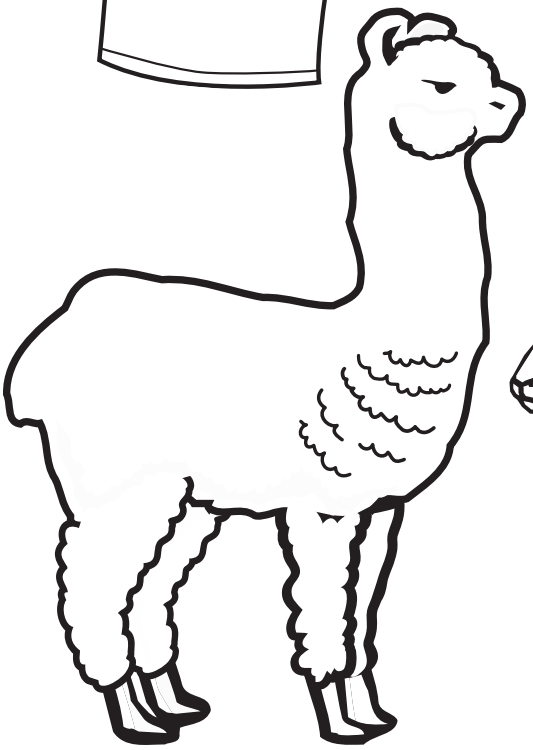
A laying hen produces an average of 250 eggs in one year.

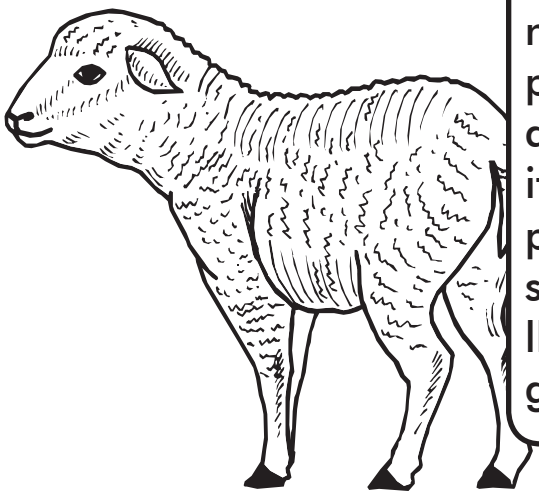
FIBER

Cotton from plants and wool from animals are types of textile fiber. Many products that we use every day are made from FIBER.









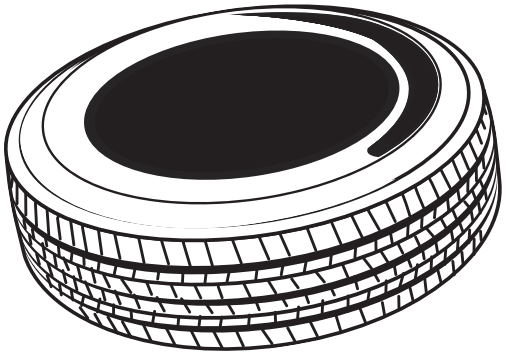
Cotton plants are used to make clothing such as jeans and household items such as towels.

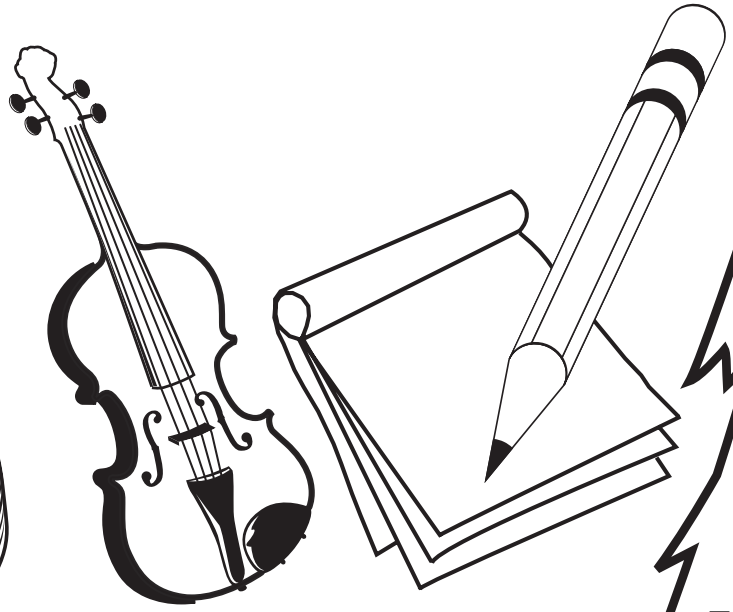
Another plant that is used to produce fiber is flax which is used to make linen.

Some animal fur can be used to make textiles for the production of clothes and other household items. Animals that produce fiber include sheep, alpacas, llamas, and some goats.

FORESTS

Trees from FORESTS are used to make more than 5,000 products that we use everyday.





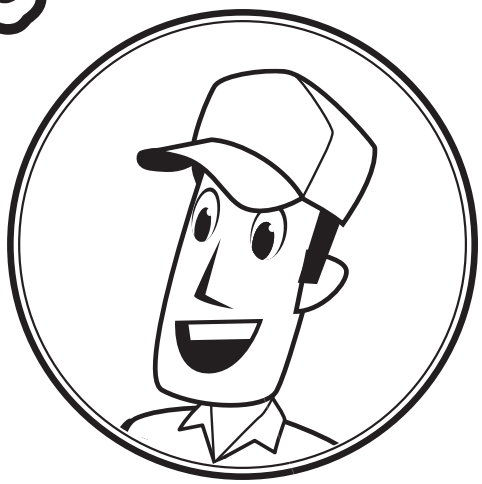
Trees are used to make:
Paper
Pencils
Wood
Cardboard boxes
Maple syrup
Firewood
Laundry soap
Tires
Cosmetics
Postage stamps
Baseball bats
Musical instruments
Toothpaste
Nail polish
Chewing gum

Fun Fact

California forests are home to more than 4,000 native plants and 650 wildlife animals.

FLOWERS

FLOWERS are a big part of California agriculture. Cut flowers, fruit trees, nursery plants, and house plants are all a part of agriculture.



Fun Fact

Mother's Day and Valentine's Day are very popular days to buy flowers.

FUEL

FUEL can be used to make energy. There are many uses for energy on the farm. Cow manure can be made into FUEL that can heat or cool buildings, or provide lighting and electricity. Corn can be made into ethanol, which is used to fuel cars, trucks and tractors.

Now that you have learned the meaning of THE FIVE F'S, it is time to review.

Activity

Match the product with the related "F."

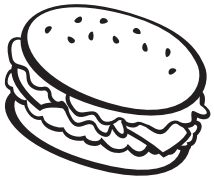
FIBER

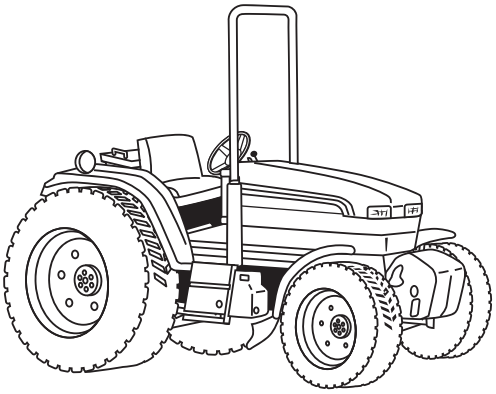
FORESTS

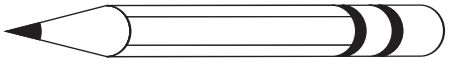
FOOD

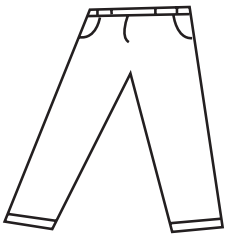
FLOWERS

FUEL









THERE'S A FARM IN MY PIZZA?

Follow the trail of how pizza is made, from the farm to the parlor.

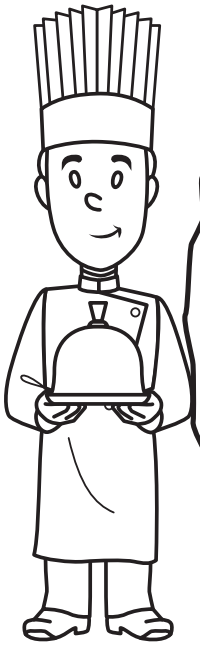
It all starts on the farm. FARMERS grow wheat, tomatoes, olives and vegetables. They raise dairy cows for milk and pigs for meat.

FARM WORKERS spend time growing and harvesting our food.

TRUCK DRIVERS transport the products to be processed.

WORKERS turn some products into the food people eat.

- Wheat is milled into flour for the crust.
- Tomatoes are cooked into sauce.
- Milk is made into cheese.
- Olives and vegetables are prepared and packaged.
- Sausage comes from pigs.



CHEFS cook the pizza—just the way you like it!

Color this pizza with your favorite toppings!

FARMERS MARKETS

FARMERS MARKETS have existed since we began farming 10,000 years ago. Historically, when families produced more food than they needed, they would meet in the town square to sell or trade their excess commodities. Farmers Markets became a traditional way of selling local agricultural products.

How many items can you find that would be sold at a Farmers Market?

S	T	U	N	L	A	W	P	U	S	S	T	D	J	T
C	E	L	M	S	S	E	M	G	B	E	Y	G	R	R
Q	P	T	L	H	A	I	K	V	S	K	V	X	L	K
T	O	J	A	C	A	B	N	O	E	O	D	I	K	F
F	R	A	H	N	S	A	I	D	T	H	I	D	L	S
H	N	E	T	M	A	H	I	J	A	C	U	T	G	O
R	S	Z	U	U	C	R	H	D	D	I	F	I	G	S
F	I	L	Z	A	L	A	G	T	G	T	E	R	C	P
Q	P	C	T	M	A	H	L	E	G	R	R	A	K	M
C	M	S	E	J	U	V	I	M	M	A	W	I	K	Z
K	I	W	I	F	R	U	I	T	O	O	J	S	X	J
P	A	M	W	Q	C	B	E	Z	O	N	P	I	J	E
K	F	S	G	T	L	Q	J	M	Q	D	D	N	K	R
G	U	I	P	O	G	H	Y	Y	T	W	A	S	O	O
V	O	A	K	Z	D	I	T	K	T	G	W	Q	R	V

Word Bag

ALMONDS
ARTICHOKES
DATES
FIGS
KIWIFRUIT
OLIVES
PEACHES
PISTACHIOS
PLUMS
POMEGRANATES
RAISINS
RICE
WALNUTS

FARMING IS EVERYWHERE

Top 3 Crops by County

Alameda Grapes, Cattle & Calves, Woody Ornamentals

Alpine Pasture & Range, Cattle, Hay

Amador Grapes, Cattle & Calves, Pasture

Butte Walnuts, Rice, Almonds

Calaveras Cattle & Calves, Poultry, Pasture

Colusa Almonds, Rice, Walnuts

Contra Costa Cattle & Calves, Tomatoes, Corn

Del Norte Milk, Cattle, Nursery

El Dorado Apples, Grapes, Cattle & Calves

Fresno Almonds, Poultry, Pistachios

Glenn Almonds, Walnuts, Rice

Humboldt Cattle & Calves, Milk, Nursery Products

Imperial Cattle & Calves, Lettuce, Alfalfa Hay

Inyo Cattle, Alfalfa Hay, Field Crops

Kern Grapes, Almonds, Milk

Kings Milk, Cotton, Cattle & Calves

Lake Grapes, Pears, Walnuts

Lassen Alfalfa Hay, Hay-other, Vegetables

Los Angeles Nursery Products, Vegetables, Field Crops

Madera Almonds, Milk, Pistachios

Marin Milk, Poultry, Pasture

Mariposa Cattle & Calves, Pasture, Livestock Products

Mendocino Grapes, Pears, Cattle & Calves

Merced Milk, Almonds, Chickens

Modoc Alfalfa Hay, Cattle & Calves, Potatoes

Mono Cattle & Calves, Alfalfa Hay, Sheep & Lambs

Monterey Strawberries, Lettuce, Broccoli

Napa Grapes, Cattle & Calves, Livestock Products

Nevada Heifers, Milk Cows, Vegetables

Orange Nursery Products, Strawberries, Vegetables

Placer Cattle & Calves, Nursery, Rice

Plumas Cattle, Pasture, Alfalfa Hay

Riverside Milk, Nursery Products, Grapes

Sacramento Grapes, Milk, Poultry

San Benito Vegetables, Lettuce, Peppers

San Bernardino Milk, Cattle & Calves, Eggs

San Diego Woody Ornamentals, Flowers, Nursery Plants

San Francisco Field Crops, Apiary Products

San Joaquin Grapes, Milk, Almonds

San Luis Obispo Grapes, Strawberries, Vegetables

San Mateo Nursery Plants, Brussels Sprouts, Flowers

Santa Barbara Strawberries, Broccoli, Grapes

Santa Clara Mushrooms, Nursery Products, Woody Ornamentals

Santa Cruz Strawberries, Raspberries, Blackberries

Shasta Hay, Nursery Products, Cattle

Sierra Cattle, Pasture, Alfalfa Hay

Siskiyou Nursery Plants, Alfalfa Hay, Cattle

Solano Walnuts, Nursery, Almonds

Sonoma Grapes, Milk, Poultry

Stanislaus Almonds, Milk, Chickens

Sutter Rice, Walnuts, Plums

Tehama Walnuts, Almonds, Olives

Trinity Range, Cattle, Irrigated Pasture

Tulare Milk, Grapes, Cattle & Calves

Tuolumne Livestock, Cattle, Pasture

Ventura Strawberries, Lemons, Celery

Yolo Almonds, Tomatoes, Grapes

Yuba Walnuts, Rice, Plums

Circle the county you live in and identify the top crops.

2017-2018 statistics information obtained from County Agricultural Commissioner Reports.

2600 River Plaza Drive, Suite 220, Sacramento, CA 95833-3293 • (800) 700-AITC • info@learnaboutag.org • LearnAboutAg.org

USDA ChooseMyPlate.gov
United States Department of Agriculture

Food labels tell you the nutritional content of a food item. You can compare two different items by using the Nutrition Facts label to choose the healthier option.

Nutrition Facts
Serving Size 1 CUP (237mL)
Servings Per Container 2

Amount Per Serving	
Calories 160	Calories from Fat 35
	%Daily Value*
Total Fat 4g	**6%**
Saturated Fat 0.5g	**3%**
Sodium 680mg	**28%**
Total Carbohydrate 24g	**8%**
Dietary Fiber 8g	**32%**
Sugars 5g	
Protein 7g	
Vitamin A 45% •	Vitamin C 20%
Calcium 6% •	Iron 15%

Not a significant source of *trans* fat, cholesterol.
* Percent Daily Values are based on a 2,000 calorie diet.

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Serving Size 1 CUP (237mL)
Servings Per Container 2

Amount Per Serving	
Calories 160	Calories from Fat 35
	%Daily Value*
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Sugars 5g	
Protein 7g	
Vitamin A 45% •	Vitamin C 20%
Calcium 6% •	Iron 15%

Not a significant source of *trans* fat, cholesterol.
* Percent Daily Values are based on a 2,000 calorie diet.

Use the Nutrition Facts label to compare food choices. The example above shows two soup options. The Nutrition Facts labels show us that the reduced-sodium vegetable soup has less sodium per serving than the original vegetable soup -- in this case half the amount. This makes the reduced-sodium vegetable soup the healthier choice, as long as the serving sizes are about the same size.

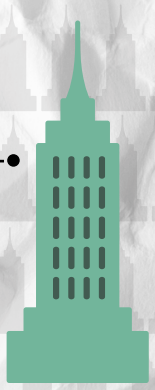
Last Updated: Mar 23, 2016

USDA
United States Department of Agriculture

Let's talk **trash.**

*Cut back on **food waste and loss** to save money, improve access to food, and protect natural resources.*

About
90 billion
pounds of edible food goes uneaten each year.*



That weighs
123x
the Empire State Building.

This cost consumers **$370** per person each year.

Reduce **wasted food** in your home with simple shopping, storage, & cooking practices.

WHAT YOU CAN DO

Plan & Save

Plan your weekly menu and make a grocery list. Does the list include food that you already have at home? Buy only what you need and stay within your budget.

Be Food Safe

Shop refrigerated or frozen foods just before checking out. Transport items that spoil easily in a cooler or thermal bag and refrigerate or freeze within two hours of shopping.

Check for Quality

The date on a food package helps the store determine how long to display the product for sale. It can also help you to choose a product at its best quality.

Set Storage Reminders

Track storage times for different foods using The FoodKeeper Application. This tool will remind you when foods are near to the end of their storage date.

Be Organized

Foods are less likely to go bad when you use the older items first. Keep your pantry and refrigerator clean and organized so you can see what needs to be eaten first.

Re-purpose

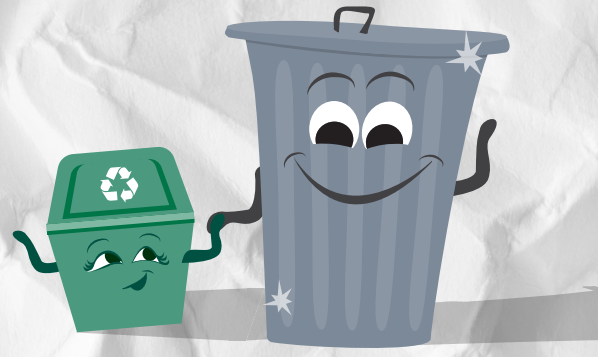
Give leftovers a makeover when you reuse them in recipes. Add broccoli stems to a salad or blend overripe fruit into a low-fat smoothie. Freeze extra food.

Donate

Many shelters, food banks, and faith-based organizations will accept food donations to feed others who need a meal.

Recycle & Compost

Instead of throwing out food, create a compost bin. Don't have a yard? Your city may help you find composting or recycling options that are right for you.



*In homes and away-from home eating places.

**Protein foods includes meat, poultry, fish, eggs, and nuts.

Sources:
All sources are available at **ChooseMyPlate.gov/lets-talk-trash**.

Center for Nutrition Policy and Promotion
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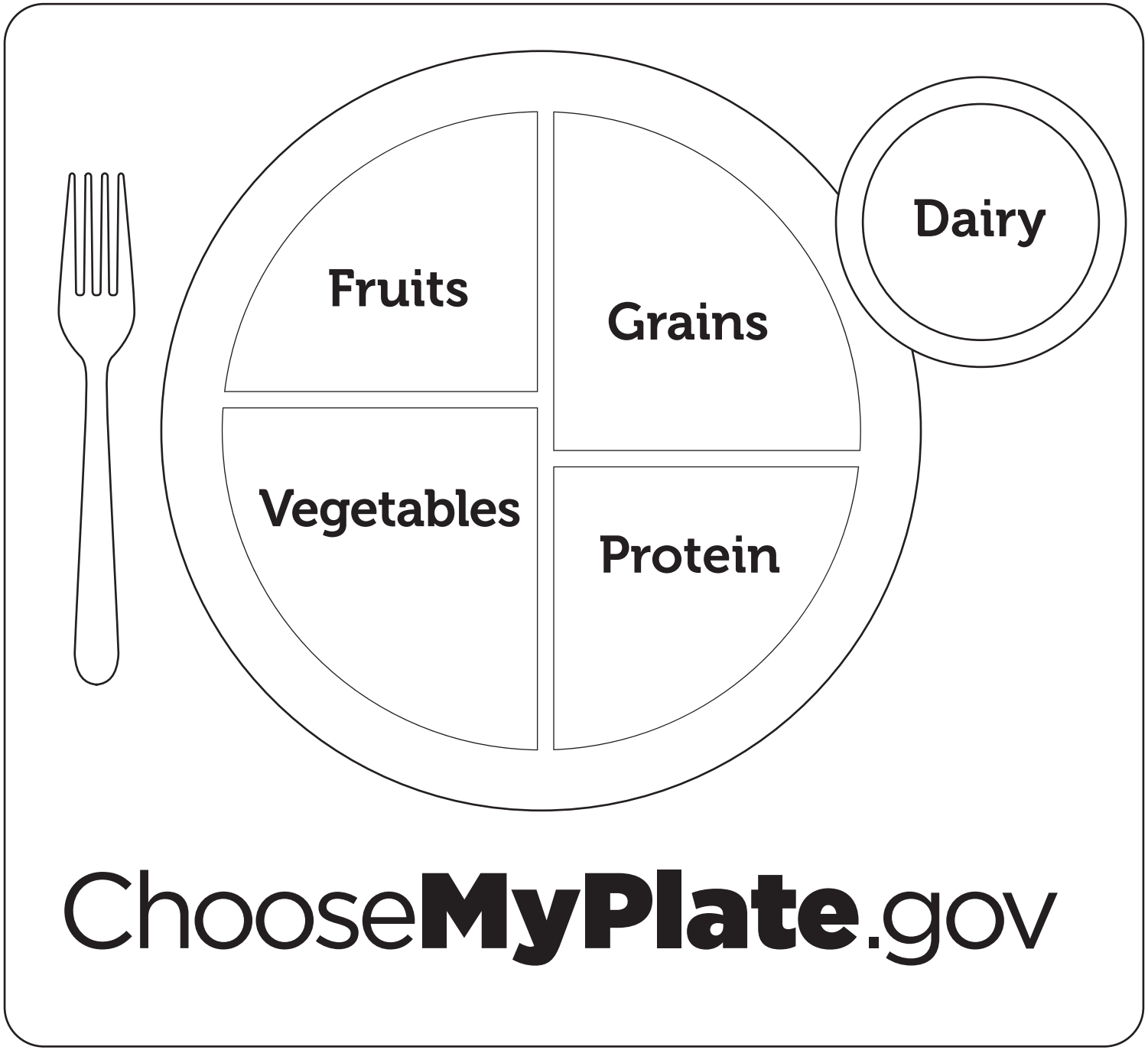

USDA Center for Nutrition Policy and Promotion

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All Forms Count!

Fruits and vegetables come in many different forms.
Fresh, frozen, canned, dried
– even 100% juice.
They're all good for you!

Put a check mark (✓) next to each form you find for the fruits and veggies listed:

	Fresh	Canned	Frozen	Dried	100% Juice
Carrots	☐	☐	☐	☐	☐
Oranges	☐	☐	☐	☐	☐
Corn	☐	☐	☐	☐	☐
Apples	☐	☐	☐	☐	☐
Spinach	☐	☐	☐	☐	☐
Apricots	☐	☐	☐	☐	☐
Bananas	☐	☐	☐	☐	☐
Cranberries	☐	☐	☐	☐	☐
Grapes	☐	☐	☐	☐	☐
Strawberries	☐	☐	☐	☐	☐
Pineapples	☐	☐	☐	☐	☐

Were you able to find any fruits or vegetables in all 5 forms?
Name them here: _

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Eat Your Colors Everyday!

It's important to eat a variety of colorful fruits and vegetables every day.
See if you can find 5 different fruits and vegetables in each of these colors.
Write your answer in the space provided.

Colors	Fruits and Veggies
Red	1._____ 2._____ 3._____ 4._____ 5._____
Blue/Purple	1._____ 2._____ 3._____ 4._____ 5._____
Yellow/Orange	1._____ 2._____ 3._____ 4._____ 5._____
Green	1._____ 2._____ 3._____ 4._____ 5._____
White	1._____ 2._____ 3._____ 4._____ 5._____

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I'm Stuck on Fruits & Veggies

Collect the PLU stickers from each piece of fruit or veggie you eat at home.
Place them on a space on this card.
(You can tape the sticker to the card, if needed.)

When your card is full,
give it to Mom and Dad for a special treat,
then begin another card!

Eat a colorful variety of fruits and veggies from all 5 color groups every day to stay healthy and fit!

LearnAboutAg®
California Foundation for Agriculture in the Classroom

Thank you for Picking A Peck of Produce!

Share your **#PickAPeck** experiences with **@LearnAboutAg!**

#LearnAboutAg #PickAPeck